ADHIYAMAAN COLLEGE OF ENGINEERING

[An autonomous institution Affiliated to Anna University, Chennai]
[Accredited by NAAC]
Dr. M.G.R Nagar, Hosur, Krishnagiri (DT) – 635 130, TAMILNADU, INDIA
REGULATIONS 2018
CHOICE BASED CREDIT SYSTEM

B.E AERONAUTICAL ENGINEERING

VISION

The department of aeronautical engineering strives to produce graduates with sustainable engineering education, technical competency, social responsibility, innovative and research skills to contribute for the national and global development.

MISSION

- To provide quality teaching, learning and research environment for a successful career in aeronautical engineering and interdisciplinary field.
- To engage the students in research and development this helps them to pursue higher education.
- To mould the students with ethical, social and intellectual qualities to become successful aeronautical engineers.

The programme defines Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes as follows:

I. PROGRAMME EDUCATIONAL OBJECTIVES [PEOs]

PEO1 (PROFESSIONALISM & CITIZENSHIP): To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological and economic issues.

PEO2 (TECHNICAL ACCOMPLISHMENTS): To provide knowledge based services to satisfy the needs of society and the industry by providing hands on experience in various technologies in core field.

PEO3 (INVENTION, INNOVATION AND CREATIVITY): To make the students to design, experiment, analyze, and interpret in the core field with the help of other multi-disciplinary concepts wherever applicable.

PEO4 (PROFESSIONAL DEVELOPMENT): To educate the students to disseminate research findings with good soft skills and become a successful entrepreneur.

PEO5 (HUMAN RESOURCE DEVELOPMENT): To graduate the students in building national capabilities in technology, education and research.

II. PROGRAMME OUTCOMES [POs]

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary 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.

III. PROGRAMME SPECIFIC OUTCOMES [PSOs]

PSO1: To mould students to become a professional with all necessary skills, personality and sound knowledge in basic and advance technological areas.

PSO2: To promote understanding of concepts and develop ability in design manufacture and maintenance of aircraft, aerospace vehicles and associated equipment and develop application capability of the concepts sciences to engineering design and processes.

PSO3: Understanding the current scenario in the field of aeronautics and acquire ability to apply knowledge of engineering, science and mathematics to design and conduct experiments in the field of Aeronautical Engineering.

PSO4: To develop leadership skills in our students necessary to shape the social, intellectual, business and technical worlds.

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CURRICULA AND SYLLABI FOR SEMESTER I TO VIII

SEMESTER I

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	118ENT01	Technical English	HSMC	2	0	0	2	2
2.	118MAT02	Engineering Mathematics - I	BSC	3	0	0	3	3
3.	118PHT03	Engineering Physics	BSC	3	0	0	3	3
4.	118CYT04	Engineering Chemistry	BSC	3	0	0	3	3
5.	118EGT05	Engineering Graphics	ESC	2	0	4	6	3
6.	118ESE02	Basic Civil, Electrical, And Electronics Engineering	ESC	3	0	0	3	3
PRACTICALS								
7.	118CYP07	Engineering Chemistry Laboratory	BSC	0	0	2	2	1
8.	118EPP07	Engineering Practice Laboratory	PCC	0	0	2	2	1
			Total	16	0	8	24	21

SEMESTER II

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	218ENT01	Communicative English	HSMC	2	0	2	4	3
2.	218MAT02	Engineering Mathematics-Ii	BSC	3	1	0	4	4
3.	218GET03	Environmental Science And Engineering	BSC	2	0	0	2	2
4.	218EMT04	Engineering Mechanics	BSC	3	0	0	3	3
5.	218PPT05	Problem Solving And Python Programming	ESC	3	0	0	3	3
6.	218BSE01	Material Science	ESC	2	0	0	2	2
PRACTICALS								
7.	218PHP07	Engineering Physics Laboratory	BSC	0	0	2	2	1
8.	218PPP08	Problem Solving And Python Programming Laboratory	ESC	0	0	2	2	1
			Total	15	1	6	22	19

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	318MAT01	Engineering Mathematics -III	BSC	3	0	0	3	3
2.	318AET02	Thermodynamics in Aeronautical Engineering	PCC	3	0	0	3	3
3.	318AET03	Fluid Mechanics and Machinery	PCC	3	0	0	3	3
4.	318AET04	Solid Mechanics	PCC	3	0	0	3	3
5.	318AET05	Production Technology	PCC	3	0	0	3	3
6.	318AEE	OE Theory I	OEC	3	0	0	3	3
PRACTICALS								
7.	318AEP06	Strength of Materials Lab	PCC	0	0	3	3	1
8.	318AEP07	Fluid Mechanics and Machinery Lab	PCC	0	0	3	3	1
9.	318AEP	OE Lab I	PEC	0	0	3	3	1
			Total	18	0	9	27	21
OPECN ELECTIVE THEORY I								
1.	318AEE06	Elements of Aeronautics	OEC	3	0	0	3	3
2.	318AEE07	Airline Operations and Management	OEC	3	0	0	3	3
3.	318AEE08	Pollution Control in Aircraft Industries	OEC	3	0	0	3	3
4.	318AEE09	Environmental Safety management	OEC	3	0	0	3	3
5.	318AEE10	Renewable Energy Systems for Aircraft	OEC	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICALS I								
1.	318AEP09	Thermodynamics Lab	PEC	0	0	3	0	1
2.	318AEP10	Aircraft Engine Repair and Maintenance Lab	PEC	0	0	3	0	1
3.	318AEP11	Communication and Navigation Lab.	PEC	0	0	3	0	1
4.	318AEP12	Aero Modeling Lab	PEC	0	0	3	0	1
5.	318AEP13	Solid Works For A/C Lab	PEC	0	0	3	0	1

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	418NMT01	Statistics and Numerical Methods	PCC	3	0	0	3	3
2.	418AET02	Aerodynamics – I	PCC	3	0	0	3	3
3.	418AET03	Aircraft Systems and Instruments	PCC	3	0	0	3	3
4.	418AET04	Aircraft Structures – I	PCC	3	0	0	3	3
5.	418AET05	Propulsion-I	PCC	3	0	0	3	3
6.	418AEE	PE Theory I	PEC	3	0	0	3	3
PRACTICALS								
7.	418AEP07	Aircraft Structures Laboratory I	PCC	0	0	2	2	1
8.	418AEP08	Aerodynamics Laboratory	PCC	0	0	2	2	1
9.	418AEP	PE Lab II	PEC	0	0	2	2	1
			TOTAL	18	0	6	24	21
PROFESSIONAL ELECTIVE THEORY I								
1.	418AEE06	Metal Joining Process and NDT	PEC	3	0	0	3	3
2.	418AEE07	Aerospace Materials	PEC	3	0	0	3	3
3.	418AEE08	Introduction to Space Technology	PEC	3	0	0	3	3
4.	418AEE09	Experimental Aerodynamics	PEC	3	0	0	3	3
5.	418AEE10	Mechanics of Machines	PEC	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICAL II								
1.	418AEP09	Aircraft Component Drawing Lab	PEC	0	0	2	2	1
2.	418AEP10	CATIA V5 R 21 Lab	PEC	0	0	2	2	1
3.	418AEP11	Production Technology Lab	PEC	0	0	2	2	1
4.	418AEP12	Modeling Lab I	PEC	0	0	2	2	1
5.	418AEP13	Aircraft Systems Lab	PEC	0	0	2	2	1

SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	518AET01	Aircraft structures II	PCC	3	0	0	3	3
2.	518AET02	Aircraft Performance	PCC	3	0	0	3	3
3.	518AET03	Aerodynamics II	PCC	3	0	0	3	3
4.	518AET04	Propulsion II	PCC	3	0	0	3	3
5.	518AEE	PE Theory II	PEC	3	0	0	3	3
6.	518AEE	OE Theory II	OEC	3	0	0	3	3
PRACTICALS								
7.	518AEP07	Aircraft Structures Laboratory II	PCC	0	0	2	2	1
8.	518AEP08	Propulsion Laboratory	PCC	0	0	2	2	1
9.	518AEP	PE Lab III	PEC	0	0	2	2	1
			TOTAL	18	0	6	24	21
PROFESSIONAL ELECTIVE THEORY II								
1.	518AEE05	Aircraft rules and regulation	PEC	3	0	0	3	3
2.	518AEE06	Airlines oPERation and management	PEC	3	0	0	3	3
3.	518AEE07	Aero-Engine Testing and PERformance Evaluation	PEC	3	0	0	3	3
4.	518AEE08	Aerospace Quality Assurance	PEC	3	0	0	3	3
5.	518AEE09	Space Flight Mechanics	PEC	3	0	0	3	3
OPECN ELECTIVE THEORY II								
1.	518AEE10	Aircraft control engineering	OEC	3	0	0	3	3
2.	518AEE11	Unmanned Aircraft Systems	OEC	3	0	0	3	3
3.	518AEE12	Introduction to Wind Tunnel Techniques	OEC	3	0	0	3	3
4.	518AEE13	Fundamentals of Flight	OEC	3	0	0	3	3
5.	518AEE14	Introduction to Space Systems	OEC	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICAL III								
1.	518AEP09	Aircraft structures Repair laboratory	PEC	0	0	2	2	1
2.	518AEP10	MAT laboratory	PEC	0	0	2	2	1
3.	518AEP11	Computer Aided Modeling And Analysis Laboratory	PEC	0	0	2	2	1
4.	518AEP12	HyPERmesh Laboratory	PEC	0	0	2	2	1
5.	518AEP13	Aircraft System Control laboratory	PEC	0	0	2	2	1

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	618AET01	Composite Materials and Structures	PCC	3	0	0	3	3
2.	618AET02	Heat Transfer	PCC	3	0	0	3	3
3.	618AET03	ExPERimental Stress Analysis	PCC	3	0	0	3	3
4.	618AET04	Finite Element Analysis	PCC	3	0	0	3	3
5.	618AEE	PE Theory III	PEC	3	0	0	3	3
6.	618AEE	OEC Theory III	OEC	3	0	0	3	3
PRACTICALS								
7.	618AEP07	Aircraft Design Lab	PCC	0	0	2	2	1
8.	618AEP08	Materials Testing Lab	PCC	0	0	2	2	1
9.	618AEP	PE Lab IV	PEC	0	0	2	2	1
			TOTAL	18	0	6	24	21
PROFESSIONAL ELECTIVE THEORY III								
1.	618AEE05	Theory of Elasticity	PEC	3	0	0	3	3
2.	618AEE06	Intellectual Property Rights	PEC	3	0	0	3	3
3.	618AEE07	Wind Tunnel Techniques	PEC	3	0	0	3	3
4.	618AEE08	Boundary layer theory	PEC	3	0	0	3	3
5.	618AEE09	Flight Testing	PEC	3	0	0	3	3
OPECN ELECTIVE THEORY III								
1.	618AEE10	Aircraft Electronics Microprocessor and Applications	OEC	3	0	0	3	3
2.	618AEE11	Space flight Navigation and Guidance	OEC	3	0	0	3	3
3.	618MEO01	Applied Hydraulics and Pneumatics	OEC	3	0	0	3	3
4.	618AEE12	Structural Dynamics	OEC	3	0	0	3	3
5.	618AEE13	Aircraft Maintenance Practice	OEC	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICAL IV								
1.	618AEP09	Aero Engine Repair laboratory	PEC	0	0	2	2	1
2.	618AEP10	Aircraft Interior Design laboratory	PEC	0	0	2	2	1
3.	618AEP11	CAD/CAM laboratory	PEC	0	0	2	2	1
4.	618AEP12	MAT Laboratory	PEC	0	0	2	2	1
5.	618AEP13	Heat Transfer Laboratory	PEC	0	0	2	2	1

SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	718AET01	Fracture Mechanics and Mechanisms	PCC	3	0	0	3	3
2.	718AET02	Avionics	PCC	3	0	0	3	3
3.	718AET03	Airline and Airport Management	PCC	3	0	0	3	3
4.	718AET04	Vibrations and Aero elasticity	PCC	3	0	0	3	3
5.	718AEE	PE Theory IV	PEC	3	0	0	3	3
6.	718AEE	OE Theory IV	OEC	3	0	0	3	3
PRACTICALS								
7.	718AEP07	Avionics and Aircraft Systems Lab	PCC	0	0	2	2	1
8.	718AEP08	Design and Fabrication of Aeromodelling (Mini Project)	PCC	0	0	2	2	1
9.	718AEP	PE Lab V	PEC	0	0	2	2	1
			TOTAL	18	0	6	24	21
PROFESSIONAL ELECTIVE THEORY IV								
1.	718AEE05	Helicopter Maintenance	PEC	3	0	0	3	3
2.	718AEE06	Helicopter Aerodynamics	PEC	3	0	0	3	3
3.	718AEE07	High Temperature Materials	PEC	3	0	0	3	3
4	718AEE08	Airworthiness and Certification	PEC	3	0	0	3	3
5.	718AEE09	Theory of Plates and Shells	PEC	3	0	0	3	3
OPEN ELECTIVE THEORY IV								
1.	718AEE10	Intel Actual Properties and Rights	OEC	3	0	0	3	3
2.	718AEE11	Principles of Management and Business Concepts	OEC	3	0	0	3	3
3.	718ME02	Non Destructive Testing and Materials	OEC	3	0	0	3	3
4.	718AEE13	Robotics and Automation	OEC	3	0	0	3	3
5.	718AEE14	Industrial Engineering and Management	OEC	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICAL V								
1.	718AEP09	Aerospace Computational Analysis Laboratory	PEC	0	0	2	2	1
2.	718AEP10	CFD Laboratory	PEC	0	0	2	2	1
3.	718AEP11	Autonomous UAV Laboratory	PEC	0	0	2	2	1
4.	718AEP12	Industrial internship	PEC	0	0	2	2	1
5.	718AEP13	Employability Skills Laboratory	PEC	0	0	2	2	1

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	818AET01	Rocket and missile	PCC	3	0	0	3	3
2.	818AEE	PE Theory V	PEC	3	0	0	3	3
3.	818AEE	PE Theory V	PEC	3	0	0	3	3
PRACTICALS								
4.	818AEP04	Project work	EEC	0	0	14	14	7
			TOTAL	9	0	14	23	16
PROFESSIONAL ELECTIVE THEORY V								
1.	818AEE02	Total Quality Management	PEC	3	0	0	3	3
2.	818AEE03	Computer Integrated Manufacturing	PEC	3	0	0	3	3
3.	818AEE04	Entrepreneurship Development, Management & IPR	PEC	3	0	0	3	3
4.	818AEE05	Computer Aided Design/Computer Aided Manufacturing	PEC	3	0	0	3	3
5.	818AEE06	Human Values and Professional Ethics	PEC	3	0	0	3	3
PROFESSIONAL ELECTIVE THEORY VI								
1.	818AEE07	Operation Research	PEC	3	0	0	3	3
2.	818AEE08	Combustion	PEC	3	0	0	3	3
3.	818AEE09	Air Transportation and Aircraft Maintenance Management	PEC	3	0	0	3	3
4.	818AEE10	Engineering optimization	PEC	3	0	0	3	3
5.	818AEE11	Gas Turbine Technology	PEC	3	0	0	3	3

118ENT01	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

The Course prepares first semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I **09**

Listening - Ink talks and gap exercises - Speaking – Asking for and giving directions - Reading – short technical texts from journals and newspapers - Writing - definitions – instructions – checklists – recommendations - Vocabulary Development - technical vocabulary - Language Development – parts of speech – articles – word formation.

UNIT II **09**

Listening - longer technical talks - Speaking – process description - Reading – longer technical texts – Writing – graphical representation - Vocabulary Development - vocabulary used in formal letters/emails and reports - Language Development – tenses - voices - numerical adjectives – question tags.

UNIT III **09**

Listening - listening to classroom lectures - Speaking – introduction to technical presentations - Reading – longer texts both general and technical and practice in speed reading – Writing – process description using sequence words and sentences - Vocabulary Development - Misspelled words – one-word substitution - Language Development - embedded sentences – singular and plural nouns - compound nouns - editing

UNIT IV **09**

Listening - Listening to documentaries and making notes - Speaking – mechanics of presentations - Reading – reading comprehension – Writing - email etiquettes - job application – cover letter – Résumé preparation - essay writing - Vocabulary Development – synonyms and antonyms – paraphrasing - Language Development – modals – conditionals.

UNIT V **09**

Listening - TED talks - Speaking – brainstorming and debate – Reading – reading and understanding technical articles – Writing – reports - minutes of a meeting - Vocabulary Development- verbal analogies - phrasal verbs - Language Development - concord - reported speech.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Read technical texts and write area- specific texts effortlessly.

CO2: Listen and comprehend lectures and talks in their area of specialization successfully.

CO3: Speak appropriately and effectively in varied formal and informal contexts.

CO4: Understand the basic grammatical structures and its applications.

CO5: Write reports and winning job applications.

TEXT BOOKS

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2. Sudharshana. N. P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.
3. Uttham Kumar. N. Technical English I (with work book). Sahana Publications, Coimbatore, 2016.

REFERENCE BOOKS

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015.
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

Students can be asked to read Tagore and Chetan Bhagat

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Read technical texts and write area- specific texts effortlessly.				2				1	1	3	1		1	1	
Co2	Listen and comprehend lectures and talks in their area of specialization successfully.				1	1				2	3	1		1		
Co3	Speak appropriately and effectively in varied formal and informal contexts.									2	3					
Co4	Understand the basic grammatical structures and its applications.										2					
Co5	Write reports and winning job applications.				2					1	2	1		1	1	1

118MAT02	ENGINEERING MATHEMATICS - I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the eigenvalue problems.
- To understand the concepts of curvatures, evolutes and envelopes.
- To learn the total derivatives and apply the same to find maxima and minima.
- To solve differential equations of certain types, including systems of differential equations that they might encounter in engineering subjects.
- To solve certain linear differential equations using the Laplace transform technique which has applications in control theory and circuit theory.

UNIT I MATRICES **9**

Eigenvalues and eigenvectors of a real symmetric matrix –Properties – Cayley - Hamilton theorem (Statement and applications only) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **9**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolutes as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Jacobians – Taylor's expansion– Maxima and Minima – Method of Lagrangian multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS **9**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients-Applications to Engineering problems-Electric Circuits, Simple Harmonic Motions and bending of beams.

UNIT V LAPLACE TRANSFORM **9**

Laplace transforms – Conditions for existence –Basic properties (Statement and applications only) – Laplace Transform of elementary functions, derivatives and integrals, unit step function and impulse functions, periodic functions. Definition of Inverse Laplace transform – Convolution theorem (Statement and applications only) – Initial and final value theorems (Statement and applications only) – Solution of linear ordinary differential equations of second order with constant coefficients using Laplace transform techniques.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to

CO1: Develop the knowledge of linear algebraic concepts.

CO2: Use the differential calculus tools application to seek solutions for many problems in engineering subjects.

CO3: Acquire the knowledge of partial differential concepts and apply to find maxima and minima of a function.

CO4: Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.

CO5: Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.

TEXT BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th edition New Delhi 2016.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.

REFERENCE BOOKS

1. T.Veerarajan, "Engineering Mathematics " Tata McGraw-Hill Publishing company, New Delhi, 2014.
2. Kandasamy.P, Thilagavathy,K., & Gunavathi.K., "Engineering Mathematics for first year "., S.Chand & Company Ltd., New Delhi,2014.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
5. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics - I", 3rd Edition, Amrutha marketing, Chennai, 2017.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Develop the knowledge of linear algebraic concepts.	3	2											3		
Co2	Use the differential calculus tools application to seek solutions for many problems in engineering subjects.	3	3											3		
Co3	Acquire the knowledge of partial differential concepts and apply to find maxima and minima of a function.	3	3											3		
Co4	Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.	3	3											3		
Co5	Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering field	3	3											3		

118PHT03	ENGINEERING PHYSICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To understand the concept of properties of matter.
- To understand the properties of sound and principles of quantization of energy.
- To understand the properties of coherent light and its importance.

UNIT-I PROPERTIES OF MATTER **9**

Elasticity – Stress – Strain diagram – Factors affecting elasticity – Twisting couple on a wire – Torsion pendulum – Young's modulus - cantilever – Uniform and Non uniform bending (theory and experiment)– Viscosity-Poiseuille's method for Coefficient of Viscosity (Qualitative).

UNIT-II ACOUSTICS AND ULTRASONICS **9**

Classification of sound, loudness, intensity – Decibel – Weber Fechner Law – Reverberation and Reverberation time – derivation of Sabine's formula for Reverberation time (Growth and Decay)– Absorption coefficient and its determination.

Introduction of Ultrasonics – Production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezoelectric generator – Detection of ultrasonic waves, properties – Cavitation – Applications – Depth of sea – Non Destructive Testing.

UNIT-III QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh–jeans' Law from Planck's theory – Compton Effect–derivation– Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Degeneracy and Non-degeneracy.

UNIT-IV LASER **9**

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion – pumping – Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers – homojunction – Applications of Laser.

UNIT-V WAVE OPTICS & FIBRE OPTICS **9**

Interference – Air wedge (theory & experiment) – Polarization– Methods of polarizing light-Theory of plane circularly and elliptically polarized light.

Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle – Types of optical fibers (material, refractive index, and mode) – Fiber optical communication system (Block diagram) – Fiber optic sensors – Temperature & Displacement sensors (Qualitative).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To understand properties of solids with different types of moduli and to gain knowledge about absorption coefficients of solids and different surfaces.
CO2: To understand basic concepts of high frequency sound waves and its applications.
CO3: To understand basic concepts of quantum mechanical behavior of wave and particle along with applications.
CO4: To understand the concepts of production of laser and its behavior with diffraction principle of interference.
CO5: To apply the concept of polarization phenomenon and thereby its applications in fiber optic communication.

TEXT BOOKS

1. R.K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi, 2003.
2. Jayaprakash R.N, 'Engineering Physics - I', Dhanam Publications, Chennai, 2007.

REFERENCE BOOKS

1. R. Murugeshan , Kiruthiga Sivaprasath , "Modern Physics", S. Chand Publications, New Delhi, 2016.
2. A. Ghatak, "Optics", The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.
3. Dr.M.N.Avadhanulu, "Introduction to Lasers: theory and applications", S.Chand publications 2012, New Delhi.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	To understand properties of solids with different types of moduli and to gain knowledge about absorption coefficients of solids and different surfaces.	3	2	1	3									3		1
Co2	To understand basic concepts of high frequency sound waves and its applications.	3	2	1	3									3		1
Co3	To understand basic concepts of quantum mechanical behavior of wave and particle along with applications.	3	2		1									3		3
Co4	To understand the concepts of production of laser and its behavior with diffraction principle of interference.	3	2	2	2									3		2
Co5	To apply the concept of polarization phenomenon and thereby its applications in fiber optic communication.	3	2	1	1									3		2

118CYT04	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To recall the terminologies of electrochemistry and explain the function of batteries and fuel cells with its electrochemical reactions.
- To understand the fundamentals of corrosion, its types and polymers with its applications.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER AND ITS TREATMENT **9**

Hardness of water - types - expression of hardness - units - estimation of hardness of water by EDTA - numerical problems -Alkalinity-types of alkalinity-determination of alkaninity-boiler troubles (scale and sludge) - treatment of boiler feed water - Internal treatment (carbonate, colloidal, phosphate and calgon conditioning) external treatment Ion exchange process, zeolite process - desalination of brackish water - Reverse Osmosis.

UNIT II ELECTROCHEMISTRY AND ENERGY STORAGE DEVICES **9**

Electrochemical cell-single electrode potential-standard electrode potential-electrochemical series and its significance-EMF of a cell- Nernst equation -Electrodes-Reference electrodes-hydrogen, calomel, quinhydrone and glass electrodes. Determination of pH of a solution using a glass electrode. Batteries - primary and secondary cells, dry cell, alkaline, lead acid storage cell, Ni-Cd battery and lithium nano battery. Clean energy fuel cells - H_2-O_2 fuel cell.

UNIT III CORROSION SCIENCE **9**

Corrosion: definition - types of corrosion: chemical and electrochemical corrosion – Pilling Bedworth ratio - types of oxide layer (stable, unstable, volatile, porous) - hydrogen evolution and oxygen absorption mechanism for electrochemical corrosion - mechanism for rusting of iron. Types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion (pitting, waterline and pipeline). Galvanic series - applications. Factors influencing corrosion: nature of metal and environment. Corrosion control methods: sacrificial anode method - impressed current Cathodic protection method - electroplating - electroless plating.

UNIT IV POLYMERS AND ITS PROCESSING **9**

Monomers - polymers - polymerization - functionality – degree of polymerization - classification of polymers based on source and applications - Molecular weight determination. Types of polymerization: addition, condensation and copolymerization - mechanism of free radical polymerization. Preparation, properties and applications of PE, PVC, Teflon, terylene, Nylon and Bakelite. Rubber-drawbacks of natural rubber-Vulcanization-Compounding of plastics - injection and blow moulding methods.

UNIT V FUELS AND COMBUSTION **9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - 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).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

CO1: Attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.

CO2: Construct an electrochemical cell and Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications.

CO3: Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes.

CO4: Differentiate the polymers used in day to day life based on its source, properties and applications.

CO5: Analyse the three types of fuels based on calorific value for selected application.

TEXT BOOKS

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCE BOOKS

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.	3			2	2					1			3	2	3
Co2	Construct an electrochemical cell and Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications.	3				2								3	2	3
Co3	Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes.	3	1											3	2	3
Co4	Differentiate the polymers used in day to day life based on its source, properties and applications.	3		1	1									3	2	3
Co5	Analyse the three types of fuels based on calorific value for selected application.	3				2					2			3	2	3

118EGT05	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

COURSE OBJECTIVES:

- To understand the graphical skills for drawing the object and the principle of free-hand sketching techniques.
- To understand the principle of orthographic projection of points, lines and plane surfaces.
- To study the principle of simple solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.

Concepts and conventions (Not for Examination)

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING 12

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.

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinders and cones when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of simple solids like prisms, pyramids, cylinders and cones in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

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

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES

The student will be able to

CO1: Recognize the conventions and apply dimensioning concepts while drafting simple objects.
CO2: Draw the orthographic projection of points, line, and plane surfaces.
CO3: Draw the orthographic projection of simple solids.
CO4: Draw the section of solid drawings and development of surfaces of the given objects.
CO5: Apply the concepts of isometric and perspective projection in engineering practice.

TEXT BOOKS

1. Ranganath G, Channankaiah and Halesh Koti, "Engineering Graphics", Second Edition, Sahana Publishers, 2015.
2. Bhatt. N.D., "Engineering Drawing" Charotar Publishing House, 53th Edition, 2014.

REFERENCE BOOKS

1. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, 2017.
2. Gopalakrishnana. K. R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2014.
3. Basant Agarwal and C.M.Agarwal, "Engineering Drawing", Tata McGraw Hill, 2013.
4. Natrajan K. V, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.
5. M.B.Shaw and B.C.Rana, "Engineering Drawing", Pearson Education India, 2011.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Recognize the conventions and apply dimensioning concepts while drafting simple objects.		2		1								1	1		1
Co2	Draw the orthographic projection of points, line, and plane surfaces.	2	1		1								1		2	
Co3	Draw the orthographic projection of simple solids.	2	2		2								1		3	
Co4	Draw the section of solid drawings and development of surfaces of the given objects.		1		2								2			2
Co5	Apply the concepts of isometric and perspective projection in engineering practice.	1	1	1							2					1

118ESE02	BASIC CIVIL, ELECTRICAL, AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To gain knowledge about Civil Engineering Materials.
2. To learn about Structural Components of Building.
3. To learn the basics of electrical elements.
4. To introduce the fundamental concepts of DC and AC circuits.
5. To interpret the principle and characteristics of semiconductor devices.

PART-A (CIVIL)

UNIT-I CIVIL ENGINEERING MATERIALS **9**

Civil Engineering Materials: Bricks, Stones, Sand, Cement, Concrete & Steel sections.
M-Sand and their types, Admixtures-Fibers and Fabrics, Superplasticizers - Selection of Materials.

UNIT - II COMPONENTS OF BUILDING **9**

Component parts of the Building -Substructure (Foundation) Types, Bearing capacity, Requirement of Good Foundations.
Superstructure: Brick Masonry, Stone Masonry, Lintels, Roofing, Flooring, Plastering
Typical cross-section showing the Buildings in a Structure, Standard Legends and Insignia

PART-B (ELECTRICAL & ELECTRONICS)

UNIT – III INTRODUCTION TO BASIC ELECTRICAL ELEMENTS **9**

Electrical circuit : passive elements - Resistor, Inductor and Capacitor; active elements- Current, Voltage, Power and Energy – Ohm's Law and limitations - Kirchhoff's Laws – relationship between current, voltage and power – Resistors in series, parallel and series -parallel circuits

UNIT - IV FUNDAMENTALS OF DC AND AC CIRCUITS **9**

DC Circuits: Sources of Electrical Energy - Independent and Dependent Source, Source Conversion - Star –Delta conversion- Mesh and Nodal Analysis.
AC Circuits: Generation of sinusoidal - voltage, average - RMS value, form factor and peak factor- Phasor diagrams of R, L, C, combination of R-L, R-C and R-L-C circuits

UNIT–V SEMICONDUCTOR DEVICES AND SWITCHING THEORY **9**

Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT, JFET -Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to:

CO1: Know the usage of surveying and properties of construction materials.
CO2: Understand the stress strain of various building and material such as substructure, road transport and bridge.
CO3: Recognize the different combinations of circuit elements and solving the circuit by applying basic circuital laws.
CO4: Acquire a good understanding of DC and AC circuits.
CO5: Demonstrate the characteristics of semiconductor devices.

TEXT BOOKS

1. Ranganath G and Channankaiah, "Basic Engineering Civil & Mechanical", S.S.Publishers, 2014.
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd, 3rd Edition reprint, 2013.
3. Muthusubramanian R, Salivahanan S, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Education Private Limited, 2010.
4. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS

1. Shanmugasundaram. S and Mylsamy. K, "Basics of Civil and Mechanical Engineering", Cenage Learning India Pvt.Ltd, New Delhi, 2012.
2. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 3rd Edition, 2012.
3. B.L.Theraja, A.K.Theraja, "A Text Book of Electrical Technology, Volume I ", S.Chand and company Ltd., 2006.
4. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Know the usage of surveying and properties of construction materials.	3	1	2	2									3		1
Co2	Understand the stress strain of various building and material such as substructure, road transport and bridge.	1		1			2							3		1
Co3	Recognize the different combinations of circuit elements and solving the circuit by applying basic circuital laws.	3	1		2									3		1
Co4	Acquire a good understanding of DC and AC circuits.	2	1	2										3		
Co5	Demonstrate the characteristics of semiconductor devices.	2	1	2										3		1

118CYP07	ENGINEERING CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- Students will be conversant with the estimation of various compounds using volumetric and instrumental analysis.

LIST OF EXPERIMENTS

1. Estimation of Total hardness by EDTA
2. Determination of percentage of calcium in Lime Stone by EDTA
3. Estimation of chloride in water sample
4. Estimation of alkalinity of Water sample
5. Determination of DO in Water (Winkler's Method)
6. Determination of Rate of Corrosion of the given steel specimen by weight loss method (Without inhibitor)
7. Determination of Rate of Corrosion of the given steel specimen by weight loss method (With inhibitor)
8. Conduct metric titration (Simple acid base)
9. Conduct metric titration (Mixture of weak and strong acids)
10. Conduct metric titration using $BaCl_2$vs Na_2 SO_4
11. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
12. PH titration (acid & base)
13. Determination of water of crystallization of a crystalline salt -Copper sulphate
14. Preparation of Bio-Diesel by Trans etherification method.

A minimum of TEN experiments shall be offered.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

CO1: Carry out the volumetric experiments and improve the analytical skills.
CO2: Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.
CO3: Understand the principle and handling of electrochemical instruments and Spectrophotometer
CO4: Apply their knowledge for protection of different metals from corrosion by using different inhibitors

REFERENCE BOOKS:

1. Arthur I. Vogel's, "Quantitative Inorganic Analysis including Elementary Instrumental Analysis", ELBS, Group, 7th Edition, 2000.
2. Dr. K .Sivakumar, "Engineering Chemistry lab manual", S.S publishers, 2016.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Carry out the volumetric experiments and improve the analytical skills.	3	3								2			3		1
Co2	Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.	3	3		2									3		1
Co3	Understand the principle and handling of electrochemical instruments and Spectrophotometer	3	3		2	3		2			3			3		1
Co4	Apply their knowledge for protection of different metals from corrosion by using different inhibitors	3	3		3	2								3		1
Co5	Demonstrate the characteristics of semiconductor devices.	3	3								1			3		1

118EPP07 **ENGINEERING PRACTICE LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To get the knowledge on welding techniques and its types.
2. To do the fitting operation on a given material. (Specimen)
3. To carry out sheet metal operation.
4. To know the principle involved in plumbing work.
5. To do the carpentry work on a given work piece.

LIST OF EXPERIMENTS

WELDING:

Study of Electric Arc welding and Gas welding tools and equipment's.

Preparation of Arc welding and Gas welding models:

i) Butt joint ii) Lap joint iii) T - joint.

FITTING:

Study of fitting tools and operations.

Preparation of fitting models: i) V-fitting ii) Square fitting

SHEET METAL WORK:

Study of sheet metal tools and operations

Preparation of sheet metal models: i) Rectangular Tray ii) Funnel

PLUMBING WORKS:

Study of pipeline joints and house hold fittings.

Preparation of plumbing models: Basic pipe connections with PVC and GI pipe fittings.

CARPENTRY:

Study of wooden joints and tools used in roofs, doors, windows, furniture.

Preparation of carpentry models:

i) Lap joint ii) Dovetail joint iii) T-Joint

DEMONSTRATION ON:

ELECTRICAL ENGINEERING PRACTICE

Study of Electrical components and equipments

Residential house wiring using switches, fuse, indicator, lamp and energy meter.

ELECTRONICS ENGINEERING PRACTICE

Study of Electronic components –Resistor, color coding, capacitors etc

Soldering practice –components soldering in simple electric circuit & testing continuity

COMPUTER HARDWARE AND SOFTWARE PRACTICE

Study of PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, Power Point and Publisher.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

The students will be able to

CO1: Prepare simple Lap, Butt and T- joints using arc welding equipments.
CO2: Prepare the rectangular trays and funnels by conducting sheet metal operation.
CO3: Prepare the pipe connections and identify the various components used in plumbing.
CO4: Prepare simple wooden joints using wood working tools.
CO5: Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.

TEXT BOOKS

1. Ranganath. G & Channankaiah, "Engineering Practices Laboratory Manual", S.S. Publishers, 2014.
2. Jeyapoovan.T & Gowri S "Engineering Practice Lab Manual", Vikas publishing house pvt.ltd, 2016.

REFERENCE BOOKS

1. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 2015.
2. Ramesh BabuV, "Engineering Practices Laboratory Manual", VRB Publishers Private Limited, Chennai, Revised Edition, 2014.
3. Peter Norton, "Introduction to Computers", 7th Edition, Mc Graw Hill, 2010.
4. Bawa. H.S, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2009.
5. David Anfinson and Ken Quamme, "IT Essentials PC Hardware and Software Companion Guide", CISCO Press, Pearson Education, Third Edition, 2008.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Prepare simple Lap, Butt and T- joints using arc welding equipments.	1		2	2	1			1	1		1	1	1		2
Co2	Prepare the rectangular trays and funnels by conducting sheet metal operation.	2		2	2	1				1		1	1	1		2
Co3	Prepare the pipe connections and identify the various components used in plumbing.	1		1	2	1				1		1	1	1		2
Co4	Prepare simple wooden joints using wood working tools.	1		1	2	1				1		1	1	1		2
Co5	Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.	1		1	1	2				1		1	1	1		2

218ENT01	COMMUNICATIVE ENGLISH	L T P C 2 0 2 3

COURSE OBJECTIVES:

The Course prepares first semester Engineering and Technology students:

- To help learners develop their listening skills which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop grammar and vocabulary of a general kind by developing their reading skills

UNIT I **09**

Listening - conversation - Speaking – introducing oneself - exchanging personal information - Reading – comprehension - Writing - paragraph - Vocabulary Development - synonyms and antonyms - Language Development – consonants & vowels - phonetic transcription.

UNIT II **09**

Listening - telephonic conversation - Speaking – sharing information of a personal kind – greeting - taking leave - Reading – short stories – The Gift of the Magi, A Service of Love and The Last Leaf by O. Henry – Writing – developing hints - Vocabulary Development – everyday vocabulary - Language Development – British and American English - infinitive and gerund.

UNIT III **09**

Listening – class memory quiz - Speaking – impromptu - Reading – magazines – Writing – agenda - proposals - Vocabulary Development - important words used in speaking and writing - Language Development – types of sentences - information and emphasis.

UNIT IV **09**

Listening – interviews of famous persons - Speaking – story narration - Reading – case study – Writing – invitation letter - quotation letter - Vocabulary Development – listening and reading vocabulary - Language Development – cause and effect – purpose and function.

UNIT V **09**

Listening - a scene from a film - Speaking - role play - Reading – jigsaw – Writing – essay writing - Vocabulary Development- business vocabulary - Language Development - degrees of comparison – real English phrases.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Comprehend conversations and talks delivered in English.
CO2: Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.
CO3: Read short stories, magazines, novels and other printed texts of a general kind.
CO4: Write short paragraphs, essays, letters and develop hints in English.
CO5: Write reports and winning job applications.

TEXT BOOKS

1. Board of Editors. Using English A Coursebook for Undergarduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2, New Delhi: CUP, 2015.
3. Uttham Kumar, N. Communicative English (with work book). Sahana Publications, Coimbatore, 2019.

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA: 2007.
5. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book & Workbook). Cambridge University Press, New Delhi: 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Comprehend conversations and talks delivered in English.				1					2	3	1		1		
Co2	Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.									1	3	1				
Co3	Read short stories, magazines, novels and other printed texts of a general kind.									1	1	1				
Co4	Write short paragraphs, essays, letters and develop hints in English.									1	3					1
Co5	Write reports and winning job applications.			3					2				1			

218MAT02	ENGINEERING MATHEMATICS-II	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To revise the concept of integral calculus and introduce Beta and Gamma functions.
- To understand double and triple integration concepts.
- To study vector calculus comprising of surface and volume integrals along with the classical theorems involving them.
- To learn analytic functions and their properties and also conformal mappings with few standard examples those have direct applications.
- To grasp the basics of complex integration and application to contour integration which is important for evaluation of certain integrals encountered in engineering problems.

UNIT-I INTEGRAL CALCULUS 12

Definite and indefinite integrals - Substitution rule – Techniques of integration –Integration by parts – Trignometric integrals - Trigonometric substitutions - Integration of rational functions by partial fractions – Integration irrational functions - Beta and Gamma functions.

UNIT-II MULTIPLE INTEGRALS 12

Double integration – Cartesian and polar co-ordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates –Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

UNIT-III VECTOR CALCULUS 12

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal, vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (Statement and applications only) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT-IV ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation and Sufficient conditions (Statement and applications only) – Harmonic and orthogonal properties of analytic function (Statement and applications only) – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w= z+c, cz, 1/z, and bilinear transformation.

UNIT-V COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points –Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the basic integration concepts and solve problems.
CO2: Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals.
CO3: Expertise the concept of vector calculus and apply in core subjects.
CO4: Construct the analytic functions and conformal transformations of complex functions.
CO5: Evaluate the integrals using complex integration.

TEXT BOOK

1. Grewal. B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.

REFERENCE BOOKS

1. James Stewart, "Stewart Calculus", 8th edition, 2015, ISBN: 9781285741550 /1285741552.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", tenth edition, Wiley India, 2011.
3. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics for first year", S.Chand & Company Ltd., 9th Edition, New Delhi, 2014.
4. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics - II", Amrutha marketing, Chennai, 2017.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Apply the basic integration concepts and solve problems.	3	2											3	3	2
Co2	Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals.	3	3											3	3	3
Co3	Expertise the concept of vector calculus and apply in core subjects.	3	3											3	3	3
Co4	Construct the analytic functions and conformal transformations of complex functions.	3	2											3	3	2
Co5	Evaluate the integrals using complex integration.	3	3											3	3	3

218GET03 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.

UNIT I NATURAL RESOURCES 9

Definition, scope and importance of environment – need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMSAND BIODIVERSITY 9

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – 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 conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **9**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **9**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

CO1: Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

CO2: Public awareness of environmental is at infant stage.

CO3: Ignorance and incomplete knowledge has led to misconceptions

CO4: Development and improvement in std. of living has led to serious environmental disasters

TEXTBOOKS

1. Benny Joseph, Environmental Science and Engineering ', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science ', 2nd edition, Pearson Education, 2004.
3. Dr. G. Ranganath, Environmental Science and Engineering, Sahana Publishers, 2018 edition.

REFERENCE BOOK

1. Dharmendra S. Sengar, Environmental law ', Prentice hall of India PVT LTD, New Delhi, 2007.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.	3			2	2		3			1			3	2	
Co2	Public awareness of environmental is at infant stage.	3				2		3						3	2	
Co3	Ignorance and incomplete knowledge has led to misconceptions	3	1					3						3	2	
Co4	Development and improvement in std. of living has led to serious environmental disasters	3		1	1			3						3	2	
Co5	Evaluate the integrals using complex integration.	3				2		3			2			3	2	

218EMT04 **ENGINEERING MECHANICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the vectorial and scalar representation of forces and moments.
- To understand the static equilibrium of particles and rigid bodies both in two dimensions.
- To understand the concepts of centroids and moment of inertia of composite sections.
- To understand the principle of work and energy.
- To enable the students to comprehend the effect of friction on equilibrium.

UNIT I BASICS & STATICS OF PARTICLES **12**

Introduction-Units and Dimensions-Laws of mechanics - Lame's theorem, Parallelogram and Triangular law of forces, Polygon force, Resolution and Composition of forces, Equilibrium of a particle-Forces in space - Equilibrium of a particle in space-Equivalent systems of forces-Principle of transmissibility-Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES **12**

Free body diagram-Types of supports and their reactions-Requirements of stable equilibrium-Moments and Couples, Moment of a force about a point and about an axis-Vectorial representation of couples-Varignon's theorem-Equilibrium of Rigid bodies in two dimensions- Equilibrium of Rigid bodies in three dimensions – Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS **12**

Determination of Areas and Volumes-First moment of area and the centroid of sections - rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula, Second and product moments of plane area - Rectangle, triangle, circle from integration-T section, I section, Angle section, Hollow section by using standard formula, Parallel axis theorem and perpendicular axis theorem.

UNIT IV DYNAMICS OF PARTICLES **12**

Displacement, Velocity and Acceleration, their relationship, Relative motion- Rectilinear motion-Curvilinear motion, Newton's law-Work Energy Equation of particles-Impulse and Momentum-Impact of elastic bodies.

UNIT V FRICTION **12**

Frictional force - Laws of Coloumb friction - Simple contact friction - Rolling resistance - Belt friction - Ladder friction - wedge friction.

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES

The students will be able to

CO1: Explain the differential principle applies to solve engineering problems dealing with force, displacement, velocity and acceleration.

CO2: Find solution for problems related to equilibrium of particles.

CO3: Solve the Moment of inertia for different 2-D plane figures.

CO4: Analyze the forces in any structures.

CO5: Solve rigid body subjected to frictional forces.

TEXT BOOKS

1. Ramamrutham S, "Engineering Mechanics (S.I Units)", Dhanpat Rai Publications, 10th Edition, Reprint 2015.
2. Dr. Gujral I S, "Engineering Mechanics", Lakmi Publications, Second Edition, 2011.

REFERENCE BOOKS

1. Bhavikatti S, "Engineering Mechanics", New Age International Publisher, 4th Edition, 2014.
2. Khurmi R S, "Engineering Mechanics", S Chand Publisher, 20th Edition, 2012.
3. Dr. Bansal R K and Sanjay Bansal, "Engineering Mechanics", Lakshmi Publication, 7th Edition, 2011.
4. Rajput R K, "Engineering Mechanics", Dhanpat Rai Publications, 3rd Edition, 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Explain the differential principle applies to solve engineering problems dealing with force, displacement, velocity and acceleration.		2											1		1
Co2	Find solution for problems related to equilibrium of particles.	1	1											2		
Co3	Solve the Moment of inertia for different 2-D plane figures.	1	2			1							1	1		1
Co4	Analyze the forces in any structures.	1	2	1	1	1							2	1		1
Co5	Solve rigid body subjected to frictional forces.	1	2	1										1		1

218PPT05 **PROBLEM SOLVING AND PYTHON PROGRAMMING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures –- lists, tuples, dictionaries.
6. To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

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, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS **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; 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: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages; Illustrative programs: word count, copy file.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries.

TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS

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

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Develop algorithmic solutions to simple computational problems	3	3	3												
Co2	Read, write, execute by hand simple Python programs.	3	3	3							1			1		
Co3	Structure simple Python programs for solving problems.	3	3	3	1				1			1				
Co4	Decompose a Python program into functions.	3	3	3												
Co5	Represent compound data using Python lists, tuples, dictionaries.	3	3	3												

218BSE01	MATERIAL SCIENCE	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To study the basic theory of structure of crystalline materials.
- To understand the essential principles of electrical properties of materials.
- To get the better knowledge of Physics of semiconductor materials.
- Become proficient in dielectric and nano materials.
- To understand the essential concepts of modern engineering materials.

UNIT I CRYSTAL PHYSICS **9**

Introduction and structure of atoms – Crystal structure: The space lattice and Unit Cell - Crystal Systems and Bravais lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, HCP and Diamond cubic structure – NaCl, ZnS structures (qualitative).

UNIT II CONDUCTING MATERIALS **9**

Conductors - Classical free electron theory of metals - Expression for electrical conductivity - Expression for Thermal conductivity - Wiedemann-Franz law - Lorentz number - Draw backs of classical theory - Quantum theory - Fermi distribution function - Effect of temperature on Fermi distribution function - Density of energy states - carrier concentration in metals.

UNIT III SEMICONDUCTING MATERIALS **9**

Intrinsic Semiconductors - direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - Fermi level - Variation of Fermi level with temperature – Electrical conductivity of intrinsic semiconductors – band gap determination - Extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (qualitative) - Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration - Electrical conductivity of extrinsic semiconductors.

UNIT IV DIELECTRIC MATERIALS AND NANOMATERIALS **9**

Dielectric materials: Dielectric constant – Dielectric loss - Electrical susceptibility- Electronic, ionic – orientational and space charge polarization – Frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation)

Nano materials: Synthesis-Plasma arcing- – Chemical vapour deposition – Electro deposition – Ball Milling – Properties of nanoparticles and their applications.

UNIT V NUCLEAR PHYSICS AND HEAT TRANSMISSION **9**

Nuclear fission-Nuclear fusion-nuclear reactors-classification-general features-efficiency-coolants moderators thermal reactors.

Heat conduction-Expression for thermal conductivity-Amount of heat flow through a plane wall in one direction-Determine the thermal conductivity –Lee's disc method for bad conductors.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will able to

CO1: Have the necessary understanding on the functioning of crystalline in solids of materials
CO2: Gain knowledge on classical and quantum electron theories, and energy band structures.
CO3: Acquire knowledge on basics of semiconductor physics and its applications in various devices.
CO4: Get knowledge on dielectric and nano materials and their applications.
CO5: Understand the basics of modern engineering materials.

TEXT BOOKS

1. Jasprit Singh, - Semiconductor Devices: Basic Principles, Wiley 2012.
2. Kasap, S.O. - Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
3. Jayaprakash R.N,-Physics for engineers, Dhanam publications, 2018.
4. Kittel, C. - Introduction to Solid State Physics. Wiley, 2005.
5. Theraja B.L - Basic Electronics Solid State, S. Chand & Company Ltd, 2004.

REFERENCE BOOK

1. Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Have the necessary understanding on the functioning of crystalline in solids of materials	3	3	2	1									2		1
Co2	Gain knowledge on classical and quantum electron theories, and energy band structures.	3	3	1	1									3		1
Co3	Acquire knowledge on basics of semiconductor physics and its applications in various devices.	3	3	1	1									3		1
Co4	Get knowledge on dielectric and nano materials and their applications.	3	3	1	1									3		1
Co5	Understand the basics of modern engineering materials.	3	2	1	1									3		1

218PHP07 **ENGINEERING PHYSICS LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To understand the practical concepts of Interference and diffraction.
- To understand the concept of velocities of sound in different liquids.
- To get better knowledge of modulus of elasticity.
- To understand the concepts of thermal conductivity.
- To understand the concepts of viscosities of liquid

LIST OF EXPERIMENTS

1. (a) Determination of laser parameters – Wavelength.
   (b) Particle size determination using Diode Laser.
2. Determination of thickness of a thin wire-Air wedge method.
3. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum-Spectrometer grating.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.
6. Determination of Young's modulus of the material –Non uniform bending.
7. Determination of viscosity of liquid – Poiseuille's method.
8. Spectrometer- Dispersive power of prism.
9. Determination of Young's modulus of the material - Uniform bending.
10. Tensional pendulum- Determination of Rigidity modulus.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understanding the moduli of elasticity by determining Young's modulus and Rigidity modulus of a beam and cylinder respectively.

CO2: Understanding the phenomenon of diffraction, dispersion and interference of light using optical component

CO3: Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid and measuring the parameters of ultrasound propagating through a liquid

CO4: Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understanding the moduli of elasticity by determining Young's modulus and Rigidity modulus of a beam and cylinder respectively.	3	3	3	3	3								3		3
Co2	Understanding the phenomenon of diffraction, dispersion and interference of light using optical component	3	3	3	3	3								3		3
Co3	Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid and measuring the parameters of ultrasound propagating through a liquid	3	3	3	3	3								3		3
Co4	Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.	3	3	3	3	3								3		3

218PPP08 **PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY** **L T P C 0 0 2 1**

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. To Implement python scripts using Variables and operators
2. To Demonstrate Operator precedence to evaluate an expression
3. Display grade of a student using elif statement
4. Implement Floyd triangle using for loop
5. Checks the given number is prime or not using while loop
6. Compute the GCD of Numbers using functions
7. Finding factorial of a given number using recursive function.
8. Takes a list of words and returns the length of longest one using strings
9. To perform linear and binary search using strings
10. To implement list as arrays (multiply 2 matrices)

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Write, test, and debug simple Python programs.

CO2: Implement Python programs with conditionals and loops.

CO3: Develop Python programs step-wise by defining functions and calling them.

CO4: Use Python lists, tuples, dictionaries for representing compound data.

CO5: Read and write data from/to files in Python.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Write, test, and debug simple Python programs.	3	3	3												
Co2	Implement Python programs with conditionals and loops.	3	3	3				1				1				
Co3	Develop Python programs step-wise by defining functions and calling them.	3	3	3						1				1		
Co4	Use Python lists, tuples, dictionaries for representing compound data.	3	3	3	1											
Co5	Read and write data from/to files in Python.	3	3	3												

SEMETER III

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	318MAT01	Engineering Mathematics -III	PC	3	0	0	3	3
2.	318AET02	Thermodynamics in Aeronautical Engineering	PC	3	0	0	3	3
3.	318AET03	Fluid Mechanics and Machinery	PC	3	0	0	3	3
4.	318AET04	Solid Mechanics	PC	3	0	0	3	3
5.	318AET05	Production Technology	PC	3	0	0	3	3
6.	318AET06	Elements of Aeronautics	OE	3	0	0	3	3
PRACTICALS								
7.	318AEP06	Strength of Materials Lab	PC	0	0	3	3	1
8.	318AEP07	Fluid Mechanics and Machinery Lab	PC	0	0	3	3	1
9.	318AEP09	Thermodynamics Lab	PE	0	0	3	3	1
			Total	18	0	9	27	21
OPEN ELECTIVE THEORY								
11.	318AEE06	Elements of Aeronautics	OE-1	3	0	0	3	3
12.	318AEE07	Airline Operations and Management	OE-2	3	0	0	3	3
13.	318AEE08	Pollution Control in Aircraft Industries	OE-3	3	0	0	3	3
14.	318AEE09	Environmental Safety management	OE-4	3	0	0	3	3
15.	318AEE10	Renewable Energy Systems for Aircraft	OE-5	3	0	0	3	3
PROFESSIONAL ELECTIVE PRACTICALS								
16.	318AEP09	Thermodynamics Lab	PEL1	0	0	3	0	1
17.	318AEP10	Aircraft Engine Repair and Maintenance Lab	PEL2	0	0	3	0	1
18.	318AEP11	Communication and Navigation Lab.	PEL3	0	0	3	0	1
19.	318AEP12	Aero Modeling Lab	PEL4	0	0	3	0	1
20.	318AEP13	Solid Works For A/C Lab	PEL5	0	0	3	0	1
			Total	0	0	15	0	5

318AET02	Thermodynamics in Aero Engineering	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To give a brief background of various laws of thermodynamics and its application in heat transfer, refrigeration and air-conditioning, jet propulsion system.
b) To study the Basics of thermodynamic cycles.
c) To study the basics of one dimensional flow and to understand the working principle of rocket motor and nozzle.
d) To study thermodynamic principles, thermodynamics of state, basic thermodynamic relations,
   Properties of pure substances
e) To understand the basics of refrigeration and air compressors.

UNIT I BASIC THERMODYNAMICS **9 Periods**

Basic Thermodynamic Systems, Zeroth Law, First Law - Heat and work transfer in flow, Second law, Clausius statement - concept of enthalpy, entropy change in non-flow processes.

UNIT II AIR CYCLES **9 Periods**

Otto, Diesel, Dual and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of two stroke and four stroke IC Engines.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW **9 Periods**

Application of continuity, momentum and energy equations- Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR CONDITIONING **9 Periods**

Principles of refrigeration, Air conditioning - Heat pumps - Vapor compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants.

UNIT V AIR COMPRESSORS **9 Periods**

Classification and working principle of compressors (Descriptive Treatment). Isothermal and Isentropic efficiency of air compressors.

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Understand the basics of laws of thermodynamics and its principles.
b) Analyze the air cycles and its problems, to solve the basic relations related to air cycles.
c) Understand the basics of one dimensional flow
d) Understand the basics of refrigeration
e) Understand the basics of air compressors

TEXT BOOKS

1. Rathakrishnan, Fundamentals of Engineering Thermodynamics, Prentice – Hall, India 2015
2. Nag. P.K., Engineering Thermodynamics, Tata McGraw-Hills Co., Ltd., Third Edition., 2014

REFERENCES

1. Mayhew, A. and Rogers, B., Engineering Thermodynamics, Longman Green & Co. Ltd., London, E.L.B.S. Edition, 2014.
2. Rajput, **E**ngineering Thermodynamics**.** Laxmi Publications pvt ltd., 3rd Edition. 2013.
3. YunusA.Cengal, Thermodynamics Engineering Approach, Tata McGraw-Hill Co. Ltd., 3rd Edition, 2014

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	Understand the basics of laws of thermodynamics and its principles. orm coding related to digital hierarchy.	3	1		3	2	3	1	3						1	
Co2	Analyze the air cycles and its problems, to solve the basic relations related to air cycles.	3	1		3	2	3	1	3						1	
Co3	Understand the basics of one dimensional flow.	3	1		3	2	3	1	3						1	
Co4	Understand the basics of refrigeration .	3	1		3	2	3	1	3						1	
Co5	Understand the basics of air compressors.		2		3	2	3	1	3						1	

318AET03	Fluid Mechanics and Machinery	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To study the basics of units and dimensions and properties of fluids.
b) To learn the fundamentals of fluid statics and fluid flow
c) To understand the importance of dimensional analysis and Buckingham's Pi Theorem and the applications of dimensionless parameters.
d) To know the types of turbine and to understand the velocity triangles
e) To understand the importance of various types of flow in pumps and turbines

UNIT I INTRODUCTION **9 Periods**

Units and Dimensions, Properties of fluids, vapour pressure and gas laws –capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUG CIRCULAR CONDUITS **9 Periods**

Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy –Weisbach equation. Friction factor and Moody diagram. Flow though pipes in series and in parallel. Minor losses

UNIT III DIMENSIONAL ANALYSIS **9 Periods**

Buckingham's Π theorem. Dimensionless parameters. Models and similitude. Applications of dimensionless parameters to the various flow problems.

UNIT IV ROTO DYNAMIC MACHINES **9 Periods**

Elementary cascade theory, Theory of turbo machines, Euler's equation, classification of turbines – Heads and efficiencies-velocity triangles. Pelton wheel turbine, Francis turbine and Kaplan turbine-working principles, centrifugal pump, specific speed-unit quantities- performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT PUMPS **9 Periods**

Classification of positive displacement pumps-Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps-Working principle and performance curves.

Total : 45 Periods

COURSE OUTCOMES:

Upon completion of this course, students will be able to

a) Acquire the knowledge regarding properties of fluids.
b) Obtained knowledge on Boundary layer concept, fluid statics, kinematics, and dynamic and the different types of flow.
b) Apply the Knowledge about the importance of dimensional analysis and Buckingham's Pi Theorem in Fluid Flow analysis
c) Students can able to understand the concepts of working of turbines with performance.
d) Students can able to understand the concepts of working of pumps with performance

TEXT BOOKS:

1) Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, seventh Edition, 2014
2) Radhakrishnan. E, Fluid Mechanics, Prentice Hall of India, Seventh Edition, 2015.

REFERENCES:

1) Frank.M.White, Fluid Mechanics, McGraw hill publication, eighth edition, Feb 2015
2) Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, DhanpatRai& Sons, Delhi, Fourth Edition, 2008.
3) Kumar. K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, Seventh Edition, 2015.

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Acquire the knowledge regarding properties of fluids.	3	1		3	2	3	1	3						1	
Co2	Analyze the air cycles and its problems, to solve the basic relations related to air cycles.	3	1		3	2	3	1	3						1	
Co3	Obtained knowledge on Boundary layer concept, fluid statics, kinematics, and dynamic and the different types of flow.	3	1		3	2	3	1	3						1	
Co4	Students can able to understand the concepts of working of turbines with performance.	3	1		3	2	3	1	3						1	
Co5	Students can able to understand the concepts of working of pumps with performance		2		3	2	3	1	3						1	

318AET04	Solid Mechanics	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To give brief descriptions on the behavior of materials due to axial loading.
b) To understand the shear force and bending moment diagrams.
c) To generate equation for deflection of beams and to understand the basic concepts of beams and column design.
d) To understand the torsion and behavior of helical springs while applying load.
e) To understand the thin circular cylinder behavior while loading.

UNIT I BASICS AND AXIAL LOADING **9 Periods**

Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Elastic constants and their relationship, Volumetric strain, expression for volumetric strain, composite bar, Thermal Stresses – stresses due to freely falling weight.

UNIT II TRANSVERSE LOADING ON BEAMS **9 Periods**

Introduction, Types of beams, loads and reactions, Shear force and bending moment diagrams for simply supported and cantilever beams-Bending stresses in straight beams-Shear stresses in bending of beams with rectangular, I & T etc cross sections-beams of uniform strength

UNIT III DEFLECTION OF BEAMS AND SHEAR STRESSES **9 Periods**

Introduction, differential equation for deflection, equations for deflections, Double integration method – McCauley's method - Area moment method – Conjugate beam method-Principle of super position-Castiglione's theorem and its application

UNIT IV TORSION AND SPRINGS **9 Periods**

Introduction, pure torsion, assumptions, Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.

UNIT V THIN CYLINDERS / SHELLS, COMPLEX STATE OF STRESS **9 Periods**

Stresses in thin circular cylinder and spherical shell under internal pressure – volumetric Strain.Combined loading – Principal Stresses and maximum Shear Stresses - Analytical and Graphical methods.

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Students are able to understand the behavior of materials due to axial, bending, tensional and combined loads.
b) Apply the knowledge of solid mechanics on various material and their properties
c) Able to analyze the beams and torsion of shafts easily.
d) Students can able to know the behavior of springs while loading
e) Acquired knowledge of thin cylinders.

TEXT BOOKS

1) Nash William.,Strength of Materials, TMH, 7th edition, 2012
2) R.K.Bansal.,Solid Mechanics, Third Edition, Laxmi Publications 2013.

REFERENCES

1. Dym C.L. and Shames I.H.,Solid Mechanics, 1990.
2. W.A. Nash, Sehaum'sOutlineSeries**,Strength of Materials,** Fourth Edition-2011.
3. Timoshenko.S. and Young D.H.,Elements of strength materials Vol. I and Vol. II., 2014.

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	Students are able to understand the behavior of materials due to axial, bending, tensional and combined loads.	3	1		3	2	3	1	3						1	
Co2	Apply the knowledge of solid mechanics on various material and their properties	3	1		3	2	3	1	3						1	
Co3	Able to analyze the beams and torsion of shafts easily.	3	1		3	2	3	1	3						1	
Co4	Students can able to know the behavior of springs while loading	3	1		3	2	3	1	3						1	
Co5	Acquired knowledge of thin cylinders.		2		3	2	3	1	3						1	

318AET05	Production Technology	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To understand the basics of casting processes and its types in Production.
b) To learn classifications and Types of Welding.
c) To learn the operation of Lathe, UMM, UDM, and CNC machines.
d) To understand the types of plastics and to learn the process of formation of plastic products.
e) To understand the Metal forming, Shaping and Power metallurgy Techniques

UNIT I CASTING **9 Periods**

Casting types, Types of Patterns-Allowances procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes-co_2moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING **9 Periods**

Classification of welding processes, Principles of Oxyacetylene gas welding. A.C. metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermal welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III MACHINING **9 Periods**

Basic Principles and Operations of following machines: Lathe, Shaper, Planer, Universal milling machine, Slotter, Universal drilling machine, cylindrical grinding machine. Basics of CNC machines.

UNIT IV PRODUCTION OF PLASTIC COMPONENTS **9 Periods**

Types of plastics -Moulding of Thermoplastics-working principles and typical applications of Injection moulding-Plunger and screw machines-Blow moulding-Rotational moulding-Film moulding-Extrusion-typical industrial applications-Thermoforming-processing of thermosets-working principles and typical applicationscompression moulding-Transfer moulding-Bonding of thermoplastics Fusion and solvent methods-Induction and Ultrasonic methods.

UNIT V METAL FORMING AND POWDER METALLURGY **9 Periods**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy-Principal steps involved advantages. Disadvantages and limitations of powder metallurgy.

Total : 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Understand the basics of casting processes in Production
b) Students will learn classifications and Types of Welding for production process
c) Students can able to understand Metal forming, Shaping and Power metallurgy Techniques.
d) Students can acquire the knowledge in production of plastic components.
e) Students can able to understand metal forming techniques.

TEXT BOOKS

1. Harijachoudry, Elements of workshop Technology, vol. I and II Media promoters and publishers pvt., Ltd., Mumbai, 2014.

2. R. K. Jain and S. C. Gupta, production Technology, Khanna Publishers. 19th Edition, 2013.

REFERENCES

1. H. M. T. production technology-Hand book, Tata McGraw-Hill, 2008.
2. Roy. A. Linberg, process and materials of manufacturing technology, PHI, 2012.
3. M. Adithyan and A. B. Gupta, manufacturing technology, New Age, 2014.

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	Understand the basics of casting processes in Production	3	1		3	2	3	1	3						1	
Co2	Students will learn classifications and Types of Welding for production process	3	1		3	2	3	1	3						1	
Co3	Students can able to understand Metal forming, Shaping and Power metallurgy Techniques.	3	1		3	2	3	1	3						1	
Co4	Students can acquire the knowledge in production of plastic components	3	1		3	2	3	1	3						1	
Co5	Students can able to understand metal forming techniques.		2		3	2	3	1	3						1	

318AEP07	Strength of Materials Laboratory	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To have the knowledge in testing of mechanical properties of materials.

LIST OF EXPERIMENTS

1. Brinell Hardness test
2. Rockwell Hardness test
3. Vickers Hardness Test
4. Tension test
5. Torsion test
6. Izod Impact test
7. Charpy Impact test
8. Study of Reverse plate bending Fatigue test
9. Study of Rotating Beam Fatigue test
10. Testing of springs
11. Block Compression Test

Total: 45 Periods

COURSE OUTCOME

a) Students can able to determine the material hardness
b) Understand the torsion properties of material.
c) Students can able to understand the loss of energy during impact.
d) Students can understand about fatigue testing and types of fatigue failure.
e) Students can able to determine the stiffness and strength of the material.
f) Students understands the various types of material testing and evaluation of mechanical properties.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Required	For Experiments
1.	Hardness Testing Machine	1	1, 2, 3
2.	Universal Testing Machine	1	4, 11
3.	Impact Testing Machine	1	6, 7
4	Torsion testing machine	1	5
5	Compressive strength test machine	1	10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Students can able to determine the material hardness	3	1		3	2	3	1	3						1	
Co2	Understand the torsion properties of material.	3	1		3	2	3	1	3						1	
Co3	Students can able to understand the loss of energy during impact.	3	1		3	2	3	1	3						1	
Co4	Students can understand about fatigue testing and types of fatigue failure.	3	1		3	2	3	1	3						1	
Co5	Students can able to determine the stiffness and strength of the material.		2		3	2	3	1	3						1	

318AEP08	Fluid Mechanics and Machinery Laboratory	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

To study the flow measurement and the performance of fluid machinery

LIST OF EXPERIMENTS

1. Calibration of venturi meter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses.
4. Verification of Bernoulli's theorem
5. Performance test on centrifugal pumps
6. Performance test on reciprocating pumps
7. Performance test on pelton wheel turbine
8. Performance test on Francis turbine
9. Performance test on Kaplan turbine
10. Determination of Viscosity of Fluid

TOTAL: 45 Periods

COURSE OUTCOME

Students are able to understand the flow measurement and the performance of fluid machinery equipments.

a) Students can able to understand the fluid passed or passing through the flowmeter.
b) Students can able to understand the bernoulli's theorem.
c) Understand the working of reciprocating pump.
d) Understand the water turbine and flow types.
e) Students can able to understand the nature of the flow of a given fluid.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	Venturimeter setup	1	1,3
2.	Pipe friction set up	1	3
3.	Pitot tube set up	1	2,4
4.	Centrifugal pump	1	5
5.	Reciprocating pump	1	6
6.	Pelton wheel turbine, Francis and Kaplan	1 (each one)	7, 8, 9

	turbine,		
7.	Viscosity Meter	1	10

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Students can able to understand the fluid passed or passing through the flowmeter.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Students can able to understand the bernoulli's theorem.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the working of reciprocating pump. .	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the water turbine and flow types.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to understand the nature of the flow of a given fluid.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEE06	Elements of Aeronautics	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) Understand the Historical evaluation of Airplanes
b) Study the different component systems and functions
c) Understand the basic properties and principles behind the flight
d) Study the different structures & construction
e) Study the various types of power plants used in aircrafts

UNIT IHISTORY OF FLIGHT **9 Periods**

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 Periods**

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 Periods**

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, Maneuvers.

UNIT IV BASICS OF PROPULSION **9 Periods**

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.

UNIT V BASICS OF AIRCRAFT STRUCTURES **9 Periods**

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.

Total: 45 Periods

COURSE OUTCOMES:

a) Learn the history of aircraft & developments over the years
b) Ability to identify the types & classifications of components and control systems
c) Understand the basic concepts of flight & Physical properties of Atmosphere
d) An ability to differentiate the types of fuselage and constructions.
e) Different types of Engines and principles of Rocket

TEXT BOOKS

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn the history of aircraft & developments over the years	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Ability to identify the types & classifications of components and control systems	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the basic concepts of flight & Physical properties of Atmosphere	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	An ability to differentiate the types of fuselage and constructions.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Different types of Engines and principles of Rocket .		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEE07	Airline and Airport Operations	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To gain practical knowledge on key airport operations for high efficiency and safety.
b) To understand the airport planning and its operations.
c) To learn Public private participation in Indian airports.
d) To understand the operational requirements of main stakeholders like airlines, authorities, ground service providers, passengers, and freight forwarders.
e) To gain knowledge about logistics and air cargo management.

UNIT I INTRODUCTION **9 Periods**

History of Aviation- Development of Air transportation in India-Major players in Airline Industry-SWOT analysis in Airline Industry-Market potential of Indian Airline Industry- Current challenges in Airline Industry Completion in Airline Industry-IATA & ICAO

UNIT II AIRPORT MANAGEMENT **9 Periods**

Airport planning-Operational area and Terminal planning, design, and operation-Airport operations-Airport functions-Organization structure of Airline and Airports sectors Airport authorities-Global and Indian scenario of Airport management – DGCA –AAI.

UNIT III AIRTRANSPORT SERVICES **9 Periods**

International trends-Emerging Indian scenario-PPP- Public Private Participation in Indian Airports-Environmental regulations-Private participation in International developments Environment regulationsRegulatory issues-Meteorological services for Aviation-Airport fees, rates, and charges

UNIT IV AIRLINE OPERATIONS **9 Periods**

Airline Terminal Management-Flight Information Counter/Reservation and Ticketing Check In/Issue of Boarding pass-Customs and Immigration formalities-Co-ordination Security Clearance-Baggage and -Handling of Unaccompanied minors and Disabled Passengers-Handling of Stretcher Passengers and Human RemainsHandling of CIP,VIP & VVIP-Co-ordination of Supporting Agencies /Departments.

UNIT V LOGISTICS AND AIR CARGO MANAGEMENT **9 Periods**

Concept of Logistics- Role of Ware Housing-trend in material handling-Global Supply Chain-Quality concept and Total Quality Management-improving Logistic performance Air Cargo Concept- Cargo Handling-Booking of Perishable Cargo and Live Animals Industry Relation-Type of Air Cargo-Air Cargo Tariff, ratios and Charges-Airway Bill, Function, Purpose, Validation.

TOTAL: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Acquired knowledge about DGCA and AAI
b) Understand the services in air transport.
c) Understand the concepts on key airport operations for high efficiency and safety.
d) Understand the basics of operational requirements of main stakeholders like airlines, authorities, ground service providers, passengers, and freight forwarders.
e) Identify areas for improvement in your operations and facilitation processes, cargo management.

TEXT BOOKS

1. Graham.A-Managing Airport an International Perspective –Butterworth Heinemann, Oxford 2013 2. Wells.A-Airport Planning and Management, 4th Edition-McGraw-hill, London-2000.

REFERENCES:

1. Alexander T.Well, Seth Young –Principles of Airport Management-McGraw Hill 2003
   P.S.Senguttuvan –Fundamentals of Airport Transport Management – McGraw Hill 2003
2. P.S.Senguttuvan –Principles of Airport Economics-Excel Books-2007
3. Richard De Neufville – Airport Systems: Planning, Design, and Management.- McGraw-Hill, London- 2007.

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	Acquired knowledge about DGCA and AAI	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understand the services in air transport.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the concepts on key airport operations for high efficiency and safety.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the basics of operational requirements of main stakeholders like airlines, authorities, ground service providers, passengers, and freight forwarders.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Identify areas for improvement in your operations and facilitation processes, cargo management.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEE08 **Pollution Control in Aircraft Industries** **L T P C**

3 0 0 3

COURSE OBJECTIVES

This course is designed

a) To understand the Knowledge of major air pollutants; their sources and their effects.
b) To understand the dispersion of air pollutants in the atmosphere.
c) To learn the pollution control techniques.
d) The students are able to strategies of reducing outdoor air pollution.
e) To know about the noise pollution and its effects.

UNIT I SOURCES AND EFFECTS OF AIR POLLTIONS **9 Periods**

Classification of Air Pollutants-Particulates and Gaseous Pollutants-Sources of Air Pollution-Source InventoryEffects of Air Pollution on Human Beings, Materials, Vegetation, Animals-Global Warming-Ozone Layer Depletion, Sampling And Analysis-Basic Principles of Sampling-Source And Ambient Sampling-Analysis of Pollutants-Principles.

UNIT II DISPERSION OF POLLUTANTS **9 Periods**

Elements of Atmosphere-Meteorological Factors-Wind Roses-Lapse Rate- Atmospheric Stability And Turbulence Plume Rise -Dispersion of Pollutants- Dispersion Models-Applications.

UNIT III AIR POLLUTION CONTROL **9 Periods**

Concepts of Control-Principles and Design of Control Measures-Particulates Control by Gravitational, Centrifugal, Filtration, Scrubbing, Electrostatic Precipitation-Selection Criteria for Equipment-Gaseous Pollutant Control by Adsorption, Absorption, Condensation, Combustion-Pollution control For Specific industries.

UNIT IV AIR QUALITY MANAGEMENT **9 Periods**

Air Quality Standards-Air Quality Monitoring-Preventive Measures-Air Pollution Control Efforts-Zoning-Town Planning Regulation of New Industries-Legislation and Enforcement-Environmental Impact Assessment and air quality.

UNIT V NOISE POLLUTION **9 Periods**

Sources of Noise Pollution-Effects -Assessment-Standards-Control Methods - Prevention

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Understand the Knowledge of major air pollutants; their sources and their effects.
b) Estimate the understanding of dispersion of air pollutants in the atmosphere and to learn the pollution control techniques
c) Analyze the strategies of reducing outdoor air pollution.
d) Acquired knowledge about air quality management.
e) Students can able to control noise pollution.

TEXTBOOKS:

1) Anjaneyulu, D,Air Pollution and Control Technologies, Allied Publishers, Mumbai, 2012.
2) RaoC.S.Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 2006.

REFERENCES

1) W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 2007
2) Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 2001.

3) Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, NewDelhi, 2005.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Understand the Knowledge of major air pollutants; their sources and their effects.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Estimate the understanding of dispersion of air pollutants in the atmosphere and to learn the pollution control technique	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Analyze the strategies of reducing outdoor air pollution.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Acquired knowledge about air quality management.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to control noise pollution.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEE09	Environmental Safety and Management	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

This course is designed

a) To Understand the Air pollution concept.
b) To Understand the characteristics of Environmental problems and Environmental Standards.
c) To Learn the usage of gas analyser, particle size analyser etc.,
d) To Learn Environmental Measurement control and Cyclone separators.
e) To Lead the implementation of environmental Preventive Management system.

UNIT I AIR POLLUTION **9 Periods**

Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution-hazards of air pollution-concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes-automobile exhausts-chemical factory stack emissions-CFC.

UNIT II ENVIRONMENTAL MANAGEMENT STANDARDS **9 Periods**

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship – Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection - Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking

UNIT III ENVIRONMENTAL MEASUREMENT AND CONTROL **9 Periods**

Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer. Gravitational settling chambers-cyclone separators-scrubber selector static precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods- Pollution Control Board-laws.

UNIT IV PREVENTIVE ENVIRONMENTAL MANAGEMENT **9 Periods**

Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies – Four Stages and nine approaches of Pollution Prevention - Getting management commitment – Analysis of Process Steps- source reduction, raw material substitution, toxic use reduction and elimination, process modification – Material balance – Technical, economic and environmental feasibility evaluation of Pollution Prevention options in selected industries – Preventive Environmental Management over Product cycle.

UNIT V ENVIRONMENTAL MANAGEMENT SYSTEM **9 Periods**

EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Understand the Air pollution concept.
b) Understand the Environmental Standards for the development of Pollution control Environment.
c) Learn Environmental Measurement control and Cyclone separators
d) Understand the implementation of environmental Preventive Management system.
e) Learn EMAS, ISO 14000, ISO 14001.

TEXT BOOKS

1. Rao, CS, "Environmental pollution engineering: , Wiley Eastern Limited, New Delhi, 2012.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, 2014

REFERENCES

1. ISO 19011: 2002, Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2012
2. Paul L Bishop Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2010.
3. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2011.

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Understand the Air pollution concept.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understand the Environmental Standards for the development of Pollution control Environment.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Learn Environmental Measurement control and Cyclone separators	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the implementation of environmental Preventive Management system.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Learn EMAS, ISO 14000, ISO 14001.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEE10 **Renewable Energy Systems for Aircraft** **L T P C**

3 0 0 3

COURSE OBJECTIVES

This course is designed

- **a)** To describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
- **b)** To Understand the solar energy conversion, principle of natural and forced convection.
- **c)** To Explain the technological basis for harnessing renewable energy sources.
- **d)** To Recognize the effects that current energy systems based on fossil fuels have over the environment and the society
- **e)** To Understand the potentials for aviations fuel.

UNIT I STATISTICS ON CONVENTIONAL ENERGY SOURCES AND SUPPLY IN DEVELOPING COUNTRIES **9 Periods**

Definition, Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES, Classification of NCES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of these energy sources.

UNIT II SOLAR ENERGY **9 Periods**

Definition, Energy available from Sun, Solar radiation data, solar energy conversion into heat, Flat plate and Concentrating collectors, Principle of natural and forced convection, Solar Engines: Stirling, Brayton engines, Photo voltaic: p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power satellite, Calculation of energy through photovoltaic power generation.

UNIT III WIND ENERGY **9 Periods**

Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Windmill rotors, Horizontal axis and Vertical axis rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant.

UNIT IV NATURE OF GEOTHERMAL SOURCES **9 Periods**

Definition and classification of resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Basic features: Atmospheric exhaust and condensing, Exhaust types of conventional steam turbines. Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Constructional details of gasifier, Usage of biogas for chullas, various types of chullas for rural energy needs.

UNIT V RENEWABLE AVIATION FUELS **9 Periods**

Potential for Renewable Aviation Fuels and Sources, renewable aviation fuel-Biodiesel, Methanol, Ethanol, Fischer-Tropsch Kerosene, Nuclear, Liquefied Bio-methane, Hydrogen, Properties of hydrogen-Properties of hydrogen aircraft-Prototypes-Proposed hydrogen aircraft

COURSE OUTCOMES

Upon completion of this course, students will be able to

- a) Describe the fundamentals and main characteristics of renewable energy sources
- b) Apply the technological basis for harnessing renewable energy sources to Industries
- c) Recognize the effects that current energy systems based on fossil fuels have over the environment and the society
- d) Learn natural geothermal sources.
- e) Acquired knowledge about renewable aviation fuels.

TEXT BOOKS

1. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 2013.
2. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 2007.

REFERENCES

1. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi 2007.
2. Boyle, G. 2004. Renewable energy: Power for a sustainable future. Oxford University press, Oxford, UK.
3. Demirbas, A. 2010. Biorefineries – for biomass upgrading facilities. Springer publishers.

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Describe the fundamentals and main characteristics of renewable energy sources	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Apply the technological basis for harnessing renewable energy sources to Industries	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Recognize the effects that current energy systems based on fossil fuels have over the environment and the society	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Learn natural geothermal sources.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Acquired knowledge about renewable aviation fuels.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEP09 **Thermodynamics Laboratory** **L T P C**

3 0 3 1

OBJECTIVE

To enhance the basic knowledge in applied thermodynamics

LIST OF EXPERIMENTS

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Determination of specific heat of solid
9. Determination of Thermal Conductivity of solid.
10. Determination of Thermal Resistance of a Composite wall.

TOTAL: 45 Periods

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	2 each	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Bomb Calorimeter	1	5, 8
5.	Vapour compression refrigeration test rig	1	6
6.	Vapour compression air-conditioning test rig	1	7
7.	Conductive Heat Transfer set up	1	9
8.	Composite wall	1	10

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Students can able to understand the working of internal combustion engine.
b) Studends can able to determine the performance test and calculate the heat transfer rate, LMTD, and effectiveness of a heat exchanger in a parallel and counter flow heat exchanger.
c) Understand the working of Vapour compression by using testing rig
d) Learn Condutive heat transfer is depends on temperature gradient between the two bodies .
e) Students can able to understand the heat transfer between composite wall depends upon the layer material.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Students can able to understand the working of internal combustion engine. .	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Studends can able to determine the performance test and calculate the heat transfer rate, LMTD, and effectiveness of a heat exchanger in a parallel and counter flow heat exchanger.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the working of Vapour compression by using testing rig.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Learn Condutive heat transfer is depends on temperature gradient between the two bodies.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to understand the heat transfer between composite wall depends upon the layer material.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEP10 **Aero Engine Repair and Maintenance Laboratory** **L T P C**
0 0 3 1

COURSE OBJECTIVE

To introduce the knowledge of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.

LIST OF EXPERIMENTS

1. Disintegration of a aircraft piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Study of Piston Engine Components - dimensional checks.
4. Engine Piston reassembly.
5. Disintegration and study of fuel system of a jet engine
6. Identification of components & trouble shooting of Jet Engine.
7. NDT checks and dimensional checks of Jet Engine
8. Engine starting procedures.
9. Ground running of aircraft.

TOTAL: 45 Periods

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No	Details of Equipment's	Qty Req.	Experiment No.
1.	Piston Engines	2	1,2,3,4
2.	Jet Aero Engines	2	5,6,7,8
3.	Aircraft with serviceable stand	1	1 to 9
4.	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI	2 each	3,1,7
5.	NDT Equipment's (Defect scope, Dye penetrant method, Hot oil Chalk Method	1 each	2,7

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Students can able to understand the installation of airplane parts.
b) Students can able to understand the process of cleaning, visual inspection, NDT checks.
c) Understand the process and able to assemble the piston engine parts.
d) Learn about the components and how to trouble shoot the jet engine.
e) Students can able to understand the operations of aircraft engine.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Students can able to understand the installation of airplanne parts. .	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Students can able to understand the process of cleaning, visual inspection, NDT checks.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the process and able to assemble the piston engine parts.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Learn about the components and how to trouble shoot the jet engine.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to understand the operations of aircraft engine.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEP11 **Aeromodelling Laboratory** **L T P C**

0 0 3 1

COURSE OBJECTIVE

To introduce the knowledge about paper glider, glider, water rockets and UAV and equip the students towards fabrication and fly test.

LIST OF EXPERIMENTS

1. Construction of paper glider
2. Design and Construction of glider
3. Design and construction of water rocketry
4. Design and fabrication of aerofoil and control surfaces (Static Model)
5. Design and fabrication of fuselage (Static Model)
6. Study about basic electronic equipments used in UAV's (servo, motor, esc, battery)
7. Assembly of UAV electronics
8. Final assembly of UAV
9. Testing and flying of UAV
10. Basic study about Hovercraft

TOTAL: 45 Periods

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No	Details of Equipment's	Qty Req.	Experiment No.
1.	A4,A3 Papers	50 Each	1
2.	Balsa Wood, Cutter ,Sand Paper, Glue	-	2,3,4,5
3.	Water bottle	50	3
4.	Thermocol, fevicol, araldite, cutter		4,5
5.	Servo motor, ESC	25	7,8,9

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Students can able to make a paper glider.
b) Students can able to understand the process of constructing a water rocketry.
c) Understand the process of fabrication.
d) Learn about the basic electronic equipments used in UAV
e) Students can able to test and fly the UAV.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Students can able to make a paper glider. . .	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Students can able to understand the process of constructing a water rocketry.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the process of fabrication.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Learn about the basic electronic equipments used in UAV.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to test and fly the UAV.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

318AEP12	Solid Works Laboratory	L	T	P	C
		0	0	3	1

COURSE OBJECTIVE

To introduce the knowledge about Basic engineering drawing, CAD modeling through solid works software

LIST OF EXPERIMENTS

1. Basics of engineering drawing
    a. Angle of projection
    b. Coordinate system
    c. Orthographic views
    d. Isometric views
2. Introduction to CAD modeling
    a. Basics of 2d modeling
    b. Basics of 3d modeling
3. Introduction to solid works
4. Creative 2d sketch by using sketcher workbench
    a. Sketch tools
    b. Profile tools
    c. Modification tools
    d. Geometrical and dimensional constrains
5. Introduction to part design workbench
    a. Sketch based features
    b. Modification features
    c. Transformation features
    d. Reference elements
6. Introduction to assemble design workbench
7. Introduction to drafting workbench
8. Design and drafting of IC-Engine valve
9. Design and drafting of piston IC-Engine
10. Design and drafting of valve flange

TOTAL: 45 Periods

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No	Details of Equipment's	Qty Req.	Experiment No.
1.	Solid works package	10 licence	1-10

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Students can able to know about the angle of projection and types of views.
b) Students can able to make models in CAD software.
c) Students can able to assemble the designs on workbench.
d) Learn about designing and drafting of engines.
e) Students can able to know all features of CAD software.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Students can able to know about the angle of projection and types of views.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Students can able to make models in CAD software.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Students can able to assemble the designs on workbench.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Learn about designing and drafting of engines.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Students can able to know all features of CAD software.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

418AET02	AERODYNMICS - I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

This course is designed

a) To builds on the student's background in Fluid Mechanics to deal primarily with internal and external flows relevant to aerospace applications.
b) To understand the concept of Airfoil theory to predict airfoil performance and optimize wing performance.
c) To evaluate and understand the Generation of Lift, wing theory and boundary layer concepts.
d) To make the student understand the concept of vorticity, irrotationality, theory of airfoils and wing sections
e) To introduce the basics of viscous flow and the concepts of mass, momentum and energy conservation relating to aerodynamics.

UNIT I BASICS OF AERODYNAMICS **9 Periods**

Properties of fluids, Type of fluid flows, Generation of Lift, Drag and Moment, Incompressible flows over airfoils, calculation of lift and drag from measured pressure distribution, Streamlined and bluff-body, Reynolds number and Mach number, Conservation law of mass and momentum, Euler and Bernoulli's equations, pitot-tube measurement of airspeed .Pressure coefficient. Streamlines, path lines and streak lines. Angular velocity, vorticity, circulation Stream function, velocity potential and their relationship.

UNIT II TWO DIMENSIONAL FLOWS **9 Periods**

Basic flows – Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows.

UNIT III GENERATION OF LIFT **9 Periods**

Kutta Joukowski's theorem. Kutta condition in Aerodynamics and Applied to Aero foils. Blasius theorem. Prandtls lifting line theory and limitations.Two dimensional and three dimensional wings lift curve slope and effect of aspect ratio. High lift devices.

UNIT IV AIRFOIL AND WING THEORY **9 Periods**

Joukowski, Karman - Trefftz, Profiles - Thin airfoil theory and its applications. Vortex line, Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations,

UNIT V VISCOUS FLOW **9 Periods**

Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate, Blasius solution. Full velocity potential equation, Fanno flow and fanno line, Rayleigh flow and Rayleigh line. Method of characteristics and its application. Flow past Wedge and cone,

Case studies:

Application of equation of motion by using Navier-stokes, parallel computation of viscous flow around the aircraft wing

Total: 45Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) Understand the background of Fluid Mechanics to analyze internal and external flows relevant to aerospace applications.
b) Apply the Knowledge of Airfoil theory to predict airfoil performance and ability to analyze and optimize wing performance.
c) Understand the Generation of Lift with different airfoils, wing theory and boundary layer concepts.
d) Apply propeller theory to predict blade performance
e) An exposure to Boundary layer theory

TEXT BOOKS

1. John D. Anderson, "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York**,**Edition**2011.**
2. John D. Anderson, "Introduction to Flight", McGraw-Hill Education, 2011. ISBN 9780071086059.
3. Kuethe, A.M and Chow, C.Y, "Foundations of Aerodynamics", Fifth Edition, John Wiley & Sons,2000

REFERENCE BOOKS

1. Ethirajan Rathakrishnan, "Theoretical aerodynamics" Willey Publication, Edition2013.
2. Clancy, L.J., "Aerodynamics", JohnWiley and sons publishers. Pitman, EditionAug 2013.
3. Houghton E.L and Carpenter P.W., Aerodynamics for Engineering Students, CBS Publications and Distributors. Edition 2012.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understand the background of Fluid Mechanics to analyze internal and external flows relevant to aerospace applications.	3	1		3	2	3	1	3						1	
Co2	Apply the Knowledge of Airfoil theory to predict airfoil performance and ability to analyze and optimize wing performance.	3	1		3	2	3	1	3						1	

Co3	Understand the Generation of Lift with different airfoils, wing theory and boundary layer concepts.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Apply propeller theory to predict blade performance	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	An exposure to Boundary layer theory		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

418AET03	AIRCRAFT SYSTEMS AND INSTRUMENTS	L	T	P	C
		3	0	0	3

COURSEOBJECTIVE

This course is designed

a) To understand the Airplane Control Systems and different Aircraft systems to enhance the aircraft by different systems.
b) To builds the strong background of a student towards Aircraft engine systems and Auxiliary systems.
c) To familiarize the student with the principles of flight test instrumentation, components of instrumentation systems, and the signal condition required to deal with typical flight test sensors.
d) To impart knowledge of the hydraulic and pneumatic systems components and types of instruments and its operation including navigational instruments to the students
e) To understand the concept of Navigation Instruments

UNIT I AIRPLANE CONTROL SYSTEMS **9 Periods**

Conventional Systems - fully powered flight controls - Power actuated systems – Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology.

UNIT II AIRCRAFT SYSTEMS **9 Periods**

Hydraulic systems - Study of typical workable system - components - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification

UNIT III ENGINE SYSTEMS **9 Periods**

Fuel systems for Piston and jet engines, - Components of multi engines. Lubricating systems for piston and jet engines Starting and Ignition systems - Typical examples for piston and jet engines.

UNIT IV AUXILIARY SYSTEM **9 Periods**

Basic Air cycle systems - Vapor Cycle systems, Evaporative vapor cycle systems - Evaporative air cycle systems - Fire protection systems, Deicing and anti-icing systems.

UNIT V AIRCRAFT INSTRUMENTS **9 Periods**

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

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) Apply the knowledge of Airplane Control Systems and different Aircraft systems to enhance the aircraft by advanced systems.
b) Design and analyze the Aircraft engine systems and Auxiliary systems for upcoming aircrafts

c) Asses the flight test instrumentation, components of instrumentation systems, and the signal condition required to deal with typical flight test sensors.
d) Acquire and interpret data from various aircraft instruments.
e) Identify the various cockpit controls.

TEXT BOOKS

1. McKinley, J.L., and Bent, R.D., "Aircraft Maintenance & Repair", McGraw-Hill, Edition 2006.
2. Ian Moir and Allan Seabridge, Aircraft Systems, mechanical, electrical and avionics subsystems integration, Wilay-blackwell, 3rdRevised Edition2008.
3. Pallet, E.H.J. Aircraft Instruments & Principles, Pitman & Co 1993.

REFERENCE BOOKS

1. Mekinley, J.L. and Bent, R.D., "Aircraft Power Plants", McGraw-Hill, Edition 2008.
2. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., Edition 2006.
3. Treager, S., "Gas Turbine Technology", McGraw-Hill, Edition 2010.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply the knowledge of Airplane Control Systems and different Aircraft systems to enhance the aircraft by advanced systems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Design and analyze the Aircraft engine systems and Auxiliary systems for upcoming aircrafts	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Asses the flight test instrumentation, components of instrumentation systems, and the signal condition required to deal with typical flight test sensors.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Acquire and interpret data from various aircraft instruments.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Identify the various cockpit controls.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AET04	**AIRCRAFT STRUCTURES - I**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To study the basics of aircraft structural parts functioning and different types of beams and columns
b) To study various types of loading and support conditions with particular emphasis on aircraft structural components.
c) To familiarize with failure theory and its real time applications
d) To provide the students an understanding on the linear static analysis of determinate and indeterminate aircraft structural components.
e) To provide the design process using different failure theories.

UNIT I INTRODUTION TO AIRCRAFT STRUCTURES AND LOADS ON AIRCRAFT 9 Periods

Structural nomenclature-types of loads, load factor, aerodynamic loads, symmetric manoeuvre loads, Detail description and functions of structural components.

UNIT II STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES 9 Periods

Analysis of plane Truss-Method of joints-3 D Truss-Plane frames-Composite beam.Propped Cantilever- Fixed-Fixed beams-Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III ENERGY METHODS 9 Periods

Strain Energy due to axial, bending and torsional loads–Castiglione's theorems- Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

UNIT IV COLUMNS 9 Periods

Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.

UNIT V FAILURE THEORY 9 Periods

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory- Maximum Strain energy theory – Application to aircraft Structural problems.

Total: 45Periods

COURSE OUTCOME

On successful completion of the course, student should be able to

a) Apply knowledge of beams and columns to solve aeronautical engineering problems.
b) Handle design and analysis of aircraft structural components.
c) Understand the failure theory and its applications.
d) Create a structure to carry the given load.

e) Examine the structural failures using failure theories

TEXT BOOK

1. Donaldson, B.K., "Analysis of Aircraft Structures on introduction", Cambridge university,Edition 2014
2. David j. peery, "Aircraft structures", Dover publication,Edition 2011.
3. N.C. Pandya, C.S. Shah, "Elements of Machine Design", Charotar Publishing House, 15th edition, 2009.

REFERENCE BOOKS

1. T H G Megson "Aircraft Structures for Engineering Students", 4th edition, Butterworth-Heinemann An imprint of Elsevier Science Edition 2006.
2. Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, Edition 1990.
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply knowledge of beams and columns to solve aeronautical engineering problems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Handle design and analysis of aircraft structural components.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Understand the failure theory and its applications.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Create a structure to carry the given load.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Examine the structural failures using failure theories		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AET05	**PROPULSION-I**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To build up necessary background for understanding the basics of aircraft propulsion.
b) To understand the application of various experimental fluid mechanics correlations in propulsion.
c) To understand the working principle of various GTE components like compressor, combustor, and Nozzles.
d) To establish fundamental approach and application of jet engine components
e) To analysis of flow phenomenon and estimation of thrust developed by jet engine.

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES **9 Periods**

Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES **9 Periods**

Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio – Diffuser performance – Supersonic inlets Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

UNIT III COMPRESSORS **9 Periods**

Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre-whirl, rotation stall and surge – Elementary theory of axial flow compressor Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

UNIT IV COMBUSTION CHAMBERS AND TURBINES **9 Periods**

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling Flame stabilization – Use of flame holders. Different types of Aircraft Turbines, operation &Working Principles

UNIT V NOZZLES **9 Periods**

Theory of flow in isentropic nozzles – nozzles and choking – Nozzle throat conditions – Nozzle efficiency Losses in nozzles – Over expanded and under – expanded nozzles – Ejector and variable area nozzles Interaction of nozzle flow with adjacent surfaces – Thrust reversal.

Total: 45 Periods

COURSE OUTCOME

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

a) Understanding the basics of propulsion system and different types of air breathing engine used in A/C
b) Understand the Performance of inlets, burners, nozzles, compressors and turbines.
c) To design and executive numerical propulsion analysis.
d) To apply ideal and actual cycle analysis to a gas turbine engine to relate thrust and fuel burn to component performance parameters.
e) Understanding the workings of multistage compressor or turbine, and to be able to use velocity triangles and the Euler Turbine Equation to estimate the performance of a compressor or turbine stage.

TEXT BOOKS

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, "Gas Turbine Theory", Prentice Hall, 6th Edition 2008.
2. Mathur, M.L &Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Std Publisher Delhi-Edi2010.
3. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson education (2009)

REFERENCE BOOKS

1. Jack D. Mattingly, "Elements of propulsion: Gas Turbine and Rockets", AIAA Education series, 2006.
2. Giampalo T. "Gas turbine Hand book", CRS Press, Edition2009.
3. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson India, 2nd Edition 2010

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understanding the basics of propulsion system and different types of air breathing engine used in A/C	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understand the Performance of inlets, burners, nozzles, compressors and turbines.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	To design and executive	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	

	numerical propulsion analysis.															
Co4	To apply ideal and actual cycle analysis to a gas turbine engine to relate thrust and fuel burn to component performance parameters.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Understanding the workings of multistage compressor or turbine, and to be able to use velocity triangles and the Euler Turbine Equation to estimate the performance of a compressor or turbine stage.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEE06	**Metal Joining Process and NDT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To understand the basics of Metal joining process
b) To study various types of metal joining process and various types of joints
c) To understand the concept of material testing and NDT
d) To study and understand the various Non-Destructive Evaluation and Testing methods, theory and their industrial applications.
e) To understand Composite materials and Damage Inspection

UNIT I BASICS OF METAL JOINING PROCESS **9 Periods**

Introduction, History, Importance of Metal Joining Processes, Types of Metal joining processes, joining process as a manufacturing route. Relevance of joining process to metallurgy. Classification of joining process. Safety aspects in Metal joining processes.

UNIT II CONVENTIONAL METAL JOINING PROCESS **9 Periods**

Introduction, classification of welding processes, Welding as compared to riveting and casting, Weld Joints & Metallurgy, Various types of weld joints & weld symbols, Standard location of elements of welding symbols, Heat affected zone and its properties. Soldering, brazing, adhesive bonding processes, Advantages and disadvantages of welding, Soldering, Brazing and Riveting

UNIT III ADVANCED METAL JOINING PROCESS **9 Periods**

Radiant energy welding processes - equipment -electron beam welding (EBW) - laser beam welding (LBW) - applications of EBW and LBW- Friction Steel Welding- Ultrasonic welding, Under water welding, Industrial applications of Modern Welding Processes Defects in welding.

UNIT IV MATERIAL TESTING **9 Periods**

Testing of Materials- Tensile testing, compression testing - Hardness Testing. Testing of Materials- Impact testing, Fatigue testing, Creep.

UNIT V NON DESTRUCTIVE TESTING **9 Periods**

Visual Inspection and Eddy current testing, liquid penetration testing, Magnetic particle testing, Radiographic testing, Ultra sonic testing, Composite Damage Inspection, X-Ray Technique, SEM, Dye Penetration Test.

Total: 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) Apply the knowledge of metal joining process and its applications to engineering field
b) Understand the concept of welding, riveting and soldering.
c) Evaluate the testing of materials and estimate different types of metal joining process

d) Students will be able to understand the concept of Ultrasonic Testing and Acoustic Emission
e) Understand the concept of Radiography

TEXT BOOKS

1. The Metallurgy of Welding, Brazing and Soldering – J.F. Lancaster, George Alien and Unwin Ltd., LondonEdition2012
2. Welding Technology- O.P. Khanna Khanna Pub, Edition 2011
3. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

REFERENCE BOOKS

1. P.N. Rao, "Manufacturing Technology", Vol. II, Tata McGraw Hill. Edition 2011
2. S V Nadkarni, Modern Arc Welding Technology, Ador Welding Limited, Edition 2010, New Delhi
3. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2 nd Edition New Jersey, 2005

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply the knowledge of metal joining process and its applications to engineering field	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understand the concept of welding, riveting and soldering.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Evaluate the testing of materials and estimate different types of metal joining process	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Students will be able to understand the concept of Ultrasonic Testing and Acoustic Emission	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Understand the concept of Radiography		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEE07	**AEROSPACE MATERIALS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To know about the basics of Aerospace materials.
b) To understand the concept of Composite materials and types of manufacturing of Polymer matrix composites
c) To understand the concept of creep, effects of creep and to study the super alloys and other materials
d) To study the types of mechanical behavior of materials for aircraft applications
e) To understand the basic concept of Super alloys.

UNIT I INTRODUCTION TO AEROSPACE MATERIALS **9 Periods**

Classification, composition, properties, heat treatment & application of plain carbon steels, alloy steels. Stainless steels. Classification, composition, properties, heat treatment &application of aluminum and its alloys. Titanium alloys, Special alloys for high temperature.

UNIT II INTRODUCTION TO COMPOSITE MATERIALS **9 Periods**

Definition – Classification of Composite materials based on structure – based on matrix. Advantages of composites – application of composites – functional requirements of reinforcement and matrix. FIBERS: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers – properties and applications of whiskers, particle reinforcements.

UNIT III MANUFACTURING OF POLYMER MATRIXCOMPOSITES **9 Periods**

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isotactic pressing.

UNIT – IV: CREEP **9 Periods**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate. Design for Creep Resistance Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monk man-Grant relationship.

UNIT –V SUPERALLOYS AND OTHER MATERIALS **9 Periods**

Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, brittlement, solidification of single crystals, Intermetallic, high temperature ceramics.

Total: 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) To know the clear idea about the basics of Aerospace materials.
b) To understand the concept of Composite materials and types of manufacturing of Polymer matrix composites
c) To know the concept of creep, effects of creep and super alloys along with other materials
d) Exposure to high temperature materials for space applications
e) Provide the necessary mathematical knowledge that are needed in understanding their significance and operation.

TEXT BOOKS

1. Material Science and Technology – Vol 13 – Composites by Cahn – VCH, West Germany Composite Materials – K.K.Chawla. 2014.

2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 2013.

3. Titterton.G., "Aircraft Materials and Processes", V Edition, Pitman Publishing Co., 1995.

REFERENCE BOOKS

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 2005.

2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 2009.

3. Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 2006.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	To know the clear idea about the basics of Aerospace materials	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	To understand the concept of Composite materials and types of manufacturing of Polymer matrix composites	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	To know the concept of creep, effects of creep and super alloys along with other materials	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	

Co4	Exposure to high temperature materials for space applications	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Provide the necessary mathematical knowledge that are needed in understanding their significance and operation.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEE08	**INTRODUCTION TO SPACE TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To provide a broad overview of the space technology with regard to rocket propulsion.
b) To develop a basic knowledge about satellite orbits, satellite dynamics and orbital elements.
c) To learn the different cases of satellite orbit transfer, orbit perturbations and Basic of rocket flight dynamics, and ballistic missile trajectories.
d) To introduce concepts of satellite injection and satellite perturbations, trajectory computation for interplanetary travel
e) To learn flight of ballistic missiles based on the fundamental concepts of orbital mechanics.

UNIT I ORBITAL MECHANICS **9 Periods**

Fundamentals of orbital dynamics, two body problem, circular and escape velocities, motion in circular, elliptical, parabolic and hyperbolic orbits, different space missions, applications, types of satellite orbits, two body problem, equation of motion, orbit equation.

UNIT II ORBITS IN THREE DIMENSIONS **9 Periods**

Different coordinate frames, coordinate transformation, Orbital elements, , relations between position and time, Effects of the earth's oblateness, Orbit perturbation due to third body, orbit decay and life time.

UNIT III ORBITAL MANEUVER **9 Periods**

Impulsive maneuvers, Hohmann transfer, one tangent burn transfer, bi-elliptic Hohmann transfer, Phasing maneuvers, Plane change maneuvers

UNIT IV ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD **9 Periods**

Multistage Rocket systems- rocket performance, restricted staging in field-free space, One dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields - Description of vertical, inclined and gravity turn trajectories.

UNIT V BALLISTIC MISSILE TRA JECTORIES **9 Periods**

Free-flight range equation, flight-path angle equation, maximum range trajectory, time of free-Flight, effect of earth rotation, effect of launching errors on range.

Total: 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) To know the broad view of the space technology with regard to rocket propulsion.
b) To understand the basic knowledge about satellite orbits, satellite dynamics and orbital elements

c) To know the different cases of satellite orbit transfer, orbit perturbations and Basic of rocket flight dynamics, and ballistic missile trajectories.
d) Estimate the trajectory/orbit of a space vehicle or a satellite in a suitable coordinate system.
e) Perform orbit perturbation analysis for satellite orbits.

TEXT BOOKS

1. Howard D. Curtis., "Orbital Mechanics for Engineering Students" Elsevier Butterworth-Heinemann, 2005

2. Cornelisse, J.W, Schoyer H F R, and Wakker K F, "Rocket Propulsion and Space Dynamic", Pitman Publishing Co., 2009.

3. Parker, E.R., "Materials for Missiles and Spacecraft", Mc.Graw Hill Book Co. Inc., 1982.

REFERENCE BOOKS

1. Martin J L Turner, "Rocket and Spacecraft Propulsion", Springer Praxis Publishing Co, Chichster, UK, 2001.

2. Bate R R, Mueller D D and White J E "Fundamentals of Astrodynamics" Dover Publications, New York, 2002

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	To know the broad view of the space technology with regard to rocket propulsion.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	To understand the basic knowledge about satellite orbits, satellite dynamics and orbital elements	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	To know the different cases of satellite orbit transfer, orbit perturbations and Basic of rocket flight dynamics, and ballistic missile trajectories.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Estimate the trajectory/orbit of a space vehicle or a satellite in a suitable coordinate system.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Perform orbit perturbation analysis for satellite orbits.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEE09	**EXPERIMENTAL AERODYNAMICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

This course is designed

a) To understand the Basics of Low speed and Subsonic Wind tunnel testing.
b) To develop a basic knowledge about the experiments in high speed tunnels.
c) To learn the measurement Techniques and special problems in different types of wind tunnels.
d) To cover both operating and application procedures of hot wire anemometer.
e) To describe flow visualization techniques and to highlight in depth discussion of analog methods.

UNIT I WIND TUNNEL TESTING **9 Periods**

Low speed wind tunnels-estimation of energy ratio and power required supersonic wind tunnels-calculation of running time and storage tank requirements.

UNIT II EXPERIMENTS IN SUBSONIC WIND TUNNELS **9 Periods**

Estimation of flow angularity and turbulence factor-calculation of CL and CD on aero foils from pressure distribution- CD from wake survey-Test section average velocity using traversing rakes-span wise load distribution for different taper ratios of wing

UNIT III EXPERIMENTS IN HIGH SPEED TUNNELS **9 Periods**

Mach number estimation in test section by pressure measurement and using a wedge – preliminary estimates of blowing and running pressures, nozzle area ratios and mass flow for a given test section size and Mach number-starting problem and starting loads.

UNIT IV MEASUREMENT TECHNIQUES **9 Periods**

Hot wire anemometer and laser Doppler anemometer for turbulence and velocity measurements-Use of thermocouples and pyrometers for measurement of static and total temperatures-Use of pressure transducers, Rota meters and ultrasonic flow meters.

UNIT V SPECIAL PROBLEMS **9 Periods**

Pitot-static tube correction for subsonic and supersonic Mach numbers-boundary layer velocity profile on a flat plate by momentum-integral method -Calculation of CD from wall shear stress-Heating requirements in hypersonic wind tunnels-Re-entry problems.

Total: 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) To Analyze the Basics flows in Low speed and Subsonic Wind tunnels.
b) To use a basic knowledge about the experiments in high speed tunnels for industrial applications.

c) To understand the measurement Techniques and special problems in different types of wind tunnels.
d) Analyze the model measurements, Lift and drag measurements through various techniques and testing of different models.
e) Apply the Wind tunnel boundary corrections and Scale effects

TEXT BOOKS

1. Rae W.H and Pope. A "Low speed wind tunnel testing" John Wiley Publication, revised edition2009
2. Pope. A and Goin. L "High speed wind tunnel testing" John Wiley, revised edition 2009

3. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.

REFERENCE BOOKS

1. Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, Edition 1989.

2. Ehirajan Rathakrishnan, "Theoretical aerodynamics" Willey Publication, Edition 2013.

3. Rathakrishnan. E "Instrumentation, Measurement and Experiments in Fluids", CRC Press, London, 2007

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	To Analyze the Basics flows in Low speed and Subsonic Wind tunnels.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	To use a basic knowledge about the experiments in high speed tunnels for industrial applications.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	To understand the measurement Techniques and special problems in different types of wind tunnels.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Analyze the model measurements, Lift and drag measurements through various techniques and testing of different models.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Apply the Wind tunnel boundary corrections and Scale effects		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEE10	**MECHANICS OF MACHINES**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE

a) To understand the basic components and layout of linkages in the assembly of a system
b) To Study the principles in analyzing the assembly with respect to the displacement.
c) To understand the basic concepts of toothed gearing and kinematics of gear trains and the mechanisms and cam mechanisms.
d) To understand the effect of friction in different machine elements.
e) To understand the importance of balancing and vibration.

UNIT I MECHANISMS **9 Periods**

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION **9 Periods**

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission.

UNIT III GEARING AND CAMS **9 Periods**

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING **9 Periods**

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

UNIT V VIBRATION **9 Periods**

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi-rotor systems – Geared shafts – Critical speed of shaft.

Total 45:Periods

COURSE OUTCOME

On successful completion of this course, student should be

a) Able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.
b) An ability to analyze the gear and cam mechanisms.
c) An ability to use different mechanisms and Torsion vibration in aircraft systems.
d) Understand the importance of Governors and Gyroscopic effects.
e) Understand the importance of vibration

TEXT BOOKS

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.

2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

3. Ambekar A.G.,Mechanism and Machine Theory Prentice Hall of India, New Delhi, 2007

REFERENCE BOOKS

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005

3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	An ability to analyze the gear and cam mechanisms.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	An ability to use different mechanisms and Torsion vibration in aircraft systems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the importance of Governors and Gyroscopic effects.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Understand the importance of vibration		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP07	**Aircraft Structures Lab - I**	**0**	**0**	**2**	**1**

COURSE OBJECTIVE

To study experimentally the load deflection characteristics structural materials under different types of loads.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using mechanical extensometers.
2. Determination of Young's modulus of aluminum using electrical extensometers
3. Determination of Strain in AL, MS and SS Using Electrical Strain Guage Setup
4. Determination of forces in statically indeterminate force system.
5. Deflection of beams with various end conditions.
6. Verification of Maxwell's Reciprocal theorem & principle of superposition
7. Column – Testing
8. Verification of Castiglione's theorem
9. Testing of Riveted Joints.
10. Determination of membrane stresses in a thin cylinder under internal pressure.

Total: 45 Periods

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No.	Equipment's	Qty	Experiments No.
1.	Universal Testing Machine	1	1,2,9
2.	Mechanical Extensometer	1	1
3.	Electrical strain gauge	10	2, 4, 10
4.	Hinged bar suspended by two wires of different materials.	1	4
5.	Strain indicator	2	2,3, 4, 10
6.	Dial Gauges	10	5, 6, 8
7.	Beam Test set up with various end conditions	2	5, 6, 8
8.	Column Test Apparatus	1	8
9.	Thin walled pressure vessel	1	10

Course Outcomes

After successful completion of this course, the students should be able to

1. Identify statically determinate and indeterminate structures.

2. Analyze the response of statically indeterminate structures under various loading conditions.

3. Determine the reactions of structures using strain energy concept.

4. Identify different numerical methods available to solve a single structural problem.

5. Examine the structural failures using failure theories.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Identify statically determine and indeterminate structures.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the response of statically indeterminate structures under various loading conditions	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Examine the structural failures using failure theories		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP08	**Aerodynamics Laboratory**	**0**	**0**	**2**	**1**

COURSE OBJECTIVE

To familiarize the students in basic aerodynamics and use of wind tunnels.

LIST OF EXPERIMENTS

1. Pressure distribution over circular cylinder.
2. Pressure distribution over airfoil and estimation of C_L and C_D.
3. Force measurement using wind tunnel balance.
4. Pressure Distribution over an symmetric Airfoil
5. Pressure Distribution on a cylinder
6. Pressure Distribution over a sphere
7. Estimation of aerodynamics characteristics of NACA0012 airfoil
8. Flow visualization in water flow channel
9. Shadow graph system to visualize the flows
10. Torque measurement using wind tunnel on symmetrical airfoil

Total: 45 Periods

COURSE OUTCOME

a) To understand the pressure distribution of circular cylinder and over airfoil, CL and CD
b) Study the wind tunnel balance and pressure distribution on symmetrical airfoil
c) Analyze pressure over an sphere and aerodynamics characteristics of NACA0012
d) Understand the visualization in water flow channel
e) Analyze the measurement using wind tunnel on symmetrical airfoil

LIST OF EQUIPMENT

(For a batch of 36 students)

Sl. No.	Items	Quantity	Experiment No.
1.	Blower, Balance and small aspect ratio model	1 each.	1
2.	Water flow channel & models	1 set	2
3.	Subsonic wind tunnel	1 No.	3, 4,5,6,7
4.	Smoke apparatus and rake	1 each.	3

5.	Manometer, Pitot-Static tube	1 No.	4,5,6
6.	Circular cylinder and Aerofoil pressure distribution models	1 each	5,6
7.	Wind tunnel strain gauge balance	1 No.	7
8.	Supersonic wind tunnel, Mercury manometer	1 No.	8,9,10
9.	Schlieren system and Shadow graph system	1 No.	9,10
10.	Sharp nosed and Blunt nosed models	1 No. each	9,10

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	To know the broad view of the space technology with regard to rocket propulsion.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	To understand the basic knowledge about satellite orbits, satellite dynamics and orbital elements	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	To know the different cases of satellite orbit transfer, orbit perturbations and Basic of rocket flight dynamics, and ballistic missile trajectories.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Estimate the trajectory/orbit of a space vehicle or a satellite in a suitable coordinate system.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Perform orbit perturbation analysis for satellite orbits.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP09	**Aircraft Component Drawing Laboratory**	**0**	**0**	**2**	**1**

COURSE OBJECTIVE

To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

LIST OF EXPERIMENTS

1. Design and Drafting of riveted joints
2. Design and Drafting of welded joints.
3. Design and Drafting Control Components Cam
4. Design and Drafting Control Components Bell Crank
5. Design and Drafting Control Components Gear
6. Design and Drafting Control Components Push-pull rod
7. Three view diagram of a typical aircraft
8. Layout of typical wing structure.
9. Layout of typical fuselage structure.
10. Layout of Control System

COURSE OUTCOME

a) Understand the design and drafting of riveted joint and welded joint
b) Analyze the design and drafting of control components cam and control components bell crank
c) To study design and drafting control components gear and push pull rod
d) To understand the diagram of typical aircraft and wing structure
e) Analyze the fuselage structure and control system

Total : 45 Periods

LIST OF EQUIPMENT
(For a batch of 36 students)

SL.NO	EQUIPMENT'S	QUANTITY	EXPERIMENTS NO.
1	Drawing Boards, Drafting machines	36	1, 5

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	An ability to analyze the gear and cam mechanisms.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	An ability to use different mechanisms and Torsion vibration in aircraft systems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the importance of Governors and Gyroscopic effects.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Understand the importance of vibration		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP10	**CATIA V5 R 21 Lab**	**0**	**0**	**2**	**1**

COURSE OBJECTIVE

To teach and train the students in the laboratory about the design and drafting of aero components.

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.

2. Wire frame modeling – surface modeling

3. Solid Modeling

4. Advanced modeling

5. CFD/FEM Fundamentals

6. Part Design of an Aircraft Components

7. Tool Design of an Aircraft Components

8. Surface Design of an Aircraft Components

COURSE OUTCOME

a) To understand the scaling rotation translation editing dimensional and wire modeling
b) Analyze the solid modeling and advanced modeling
c) Study the CFD/FEM fundamental and prat design of an aircraft components
d) Check about the tool design aircraft components and surface design

Total : 45 Periods

LIST OF EQUIPMENT:

(For a batch of 36 students)

Sl. No.	Name of the Equipment	Quantity	Experiment
1	Computers	36	**No.**
2	CATIA V5 R13,SOLIDWORKS	36 licenses	1 to 10
3	UPS 10 KV a 3 Phase	1	1 to 10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Identify statically determine and indeterminate structures.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the response of statically indeterminate structures under various loading conditions	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Examine the structural failures using failure theories		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP11	**PRODUCTION TECHNOLOGY LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVE

The main objective of this course is

To emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used

LIST OF EXPERIMENTS

1. LATHE

1.1. Facing, plain turning and step turning
1.2. Taper turning using compound rest.
1.3. Taper turning using taper turning attachment
1.4. Single start V thread, cutting and knurling
1.5. Boring and internal thread cutting.

2. SHAPER AND SLOTTER

2.1. Machining a V- block (in a Shaper)

2.2. Machining hexagonal shape (in a Shaper)

2.3. Machining internal key-way (in a slotter)

3. DRILLING

3.1 Drilling 4 or 6 holes at a given pitch circle on a plate

3.2. Drilling, reaming and tapping

4. MILLING

4.1. Plain Milling Exercise

4.2. Gear Milling Exercise

5. GRINDING

Cylindrical Grinding Exercise

Total : 45 Periods

Course Outcome

a) To understand the lathe(facing plain taper turning single start boring)

b) Study about the shaper and slotter

c) Analyze the drilling
d) Understand the milling and its experiments
e) To study the grinding

LIST OF EQUIPMENTS

(For A Batch Of 36 Students)

1.	Centre Lathe with accessories	5No.
2.	Shaping Machine	2 No.
3.	Slotting Machine	1 No.
4.	Radial Drilling Machine	2No.
5.	Upright Drilling Machine	2No.
6.	Milling Machine	2No.
7.	Cylindrical Grinding Machine	1 No.

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	An ability to analyze the gear and cam mechanisms.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	An ability to use different mechanisms and Torsion vibration in aircraft systems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Understand the importance of Governors and Gyroscopic effects.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Understand the importance of vibration		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP12	**Modelling Laboratory I**	0	0	2	1

COURSE OBJECTIVE

To understand the basic concepts of Modeling and carry out experiments that solves fluid flow problem using commercially available CFD software.

LIST OF EXPERIMENTS

1. In viscid Modeling Flow over an Airfoil
2. Modeling of Compressible Flow over an Airfoil.
3. Modeling of heat exchanger through an Elbow
4. Cavity Modeling for an Vortex flow
5. Modeling & Analysis of Flow in an Intake Manifold
6. Modeling & Analysis of Flow and Heat Transfer over a Flat Plate
7. Modeling & Analysis of a Cavity flow analysis
8. Modeling & Analysis of Turbulent Flow in a Mixing Tank
9. Non-Newtonian Transitional flow in an Eccentric Annulus
10. Modeling a 3d combustion chamber

Total : 45 Periods

Course Outcome

a) Knowledge about the modeling and modeling of compressible flow over an airfoil
b) Understand the modeling of heat exchanger and cavity modeling for an vortex flow
c) Study about the flow in the intake manifold and heat transfer over a flat plate
d) Analyze the cavity flow in mixing tank and turbulent flow in mixing tank
e) Knowledge about the eccentric annulus and combustion chamber

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipment's	Qty Req.	Experiment No.
1.	CFD Modeling & Analysis Software	10 License	1 to 11
2.	Computers of configuration 2 gb ram, Dual Core Processor, 320 HD.	36	1 to 11

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Identify statically determine and indeterminate structures.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the response of statically indeterminate structures under various loading conditions	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Examine the structural failures using failure theories		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

		L	T	P	C
418AEP13	**Aircraft Systems Lab**	0	0	2	1

COURSE OBJECTIVE

To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.

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 : 45 Periods

COURSE OUTCOME

a) Knowledge the jacking up procedure and levelling procedure
b) Study the rigging check procedure and aircraft symmetry
c) Understand the filter element and hydraulic External/Internal Leakage
d) Study the Functional Test" to adjust operating pressure and on fuel system components
e) Understand the wheel brake units and wheel brake units

LIST OF EQUIPMENTS

(for a batch of 36 students)

S.No	Items	Quantity	Experiment No.
1	Hydraulic System	1	1,2,3,4
2	Fuel System		6,8
3	Brake Load Test Equipment	1	7,8,9,10

4	Hydraulic Jacks (Screw Jack)	5	1,2,3,4,
5	Trestle adjustable	5	1,2,4,8
6	Spirit Level	2	1,2,4,8
7	Levelling Boards	2	8
8	Cable Tensiometer	1	8
9	Adjustable Spirit Level	1	8
10	Plumb Bob	1	8

Course Outcome		**PSO1**	**PSO2**	**PSO3**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Co1	Identify statically determine and indeterminate structures.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the response of statically indeterminate structures under various loading conditions	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Determine the reactions of structures using strain energy concept	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Examine the structural failures using failure theories		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

518AET01 **Aircraft Structures II**

L	T	P	C
3	0	0	3

PRE-REQUISITE:- Knowledge of Aircraft Structures I

COURSE OBJECTIVE

The Students will be able to

a) Study the behavior of various aircraft structural components under different types of loads.
b) Describe forces acting on structural members and to study the shear flow in open and closed sections
c) Understand the Buckling of Plates with Crippling Stresses and different methods
d) Analyze the stress in wing and fuselage with Shear and bending moment.
e) To describe the stress analysis in wing and fuselage

UNIT I BENDING STRESS **9 Periods**

Bending stresses in beams of symmetrical sections – Bending of symmetric sections with Skew Loads and unsymmetrical sections with Skew Loads. Numerical Problems.

UNIT II SHEAR FLOW IN OPEN SECTIONS **9 Periods**

Thin walled beams, Concept of shear flow, shear Centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT III SHEAR FLOW IN CLOSED SECTIONS **9 Periods**

Bredt – Batho formula, Single and multi – cell structures. Approximate methods. Shear flow in single &multi-cell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

UNIT IV BUCKLING OF PLATES **9 Periods**

Introduction to theory of plates & shells. Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham's and Gerard's methods, Thin walled column strength. Sheet stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE **9 Periods**

Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam. With parallel and non-parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

TOTAL: 45 Periods

COURSE OUTCOME

Upon successful completion of the course, students will be able to

a) Understand the behavior of various aircraft structural components under different types of loads
b) Build the Knowledge about shear flow in open and closed sections of aircraft structural parts
c) Apply the concept of Buckling and Crippling stresses with different methods
d) Simplify the Analysis of the stress in wing and fuselage with Shear and bending moment.
e) To understand the stress analysis in wing and fugelage

TEXT BOOKS

1. Megson T.M.G "Aircraft Structures for Engineering Students" published by Edward Arnold 2014.
2. D.J Peery and J.J. Azar "Aircraft Structures", published by McGraw-Hill, N.Y.2012.

REFERENCE BOOKS

1. E.H. Bruhn, published "Analysis and Design of Flight vehicles Structures" byTri-State off set company, USA, 2004.
2. S.P. Timoshenko and S.W. Krieger, "Theory of Plates and Shells" published by McGraw Hill 2014.
3. C.T.Sun "Mechanics of Aircraft Structures" 4th Edition, Prentice Hall India, 2015.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understand the behavior of various aircraft structural components under different types of loads	**3**	**1**		**3**	**2**	**2**	**1**	**3**						**2**	
Co2	Build the Knowledge about shear flow in open and closed sections of aircraft structural parts	**3**	**1**		**2**	**1**	**2**	**1**	**3**						**2**	
Co3	Apply the concept of Buckling and Crippling stresses with different methods	**3**	**1**		**3**	**2**	**3**	**11**	**3**						**2**	
Co4	Simplify the Analysis of the stress in wing and fuselage with Shear and bending moment.	**3**	**1**		**3**	**1**	**1**	**1**	**3**						**2**	
Co5	To understand the stress analysis in wing and fugelage		**2**		**3**	**2**	**2**	**1**	**3**						**2**	

518AET02 **Aircraft Performance**

L	T	P	C
3	0	0	3

PRE-REQUISITE :- Knowledge of Aerodynamics and Elements of Aeronautics

COURSE OBJECTIVE

The Students will be able to

a) Study the Basics of Flight Performance under various conditions
b) Describe the various climbing and turning performance of an aircraft
c) Learn the condition for minimum drag and minimum power in an aircraft.
d) Understand the Special performances of an aircraft engines and to study about propellers
e) To Describe the propellers and various performance of propollers

UNIT I FLIGHT PERFORMANCE **9 Periods**

Streamlined and bluff bodies, aerofoil classification, Aerofoil characteristics, Pressure distribution around aerofoil's. Types of drag, Effects of Reynolds's number on skin friction and pressure drag, Drag reduction of airplanes. , Induced drag, Chordwise and spanwise pressure distribution. Aspect ratio, Camber and plan form characteristics, drag polar.

UNIT II STEADY FLIGHT **9 Periods**

Steady level flight, Thrust/power, available and required with altitude Estimation of maximum level flight speed, conditions for minimum drag and minimum power, maximum range and gliding.

UNIT III CLIMBING AND TURNING PERFORMANCE **9 Periods**

Minimum rate of skin a glide, Take off power, Rate of glide, Shallow angle of climb, Rate of climb, time to climb and ceilings, Glide hodograph. Bank angle and load factor, Limitations on turn, Pull up and push over, the v-n diagram.

UNIT IV SPECIAL PERFORMANCE **9 Periods**

Aero Engine (Piston, Jet) Range and endurance of jet and propeller type of airplanes estimation of take-off and landing distance. High lift devices, Use of thrust augmentation and reverse thrust.

UNIT V PROPELLERS **9 Periods**

Froude momentum and blade element theories, Propeller coefficients, Use of propeller charts, performance of fixed and variable pitch propeller.

Total: 45 Periods

COURSE OUTCOME:

Upon completion of this course, students will be able to

a) Apply the knowledge of Basics of Flight Performance under various conditions to Aircraft industry.
b) Understand the various climbing and turning performance of an aircraft
c) Analyze the condition for minimum drag and minimum power in an aircraft.
d) Examine the Special performances of an aircraft engines and to study about propellers.
e) Build the knowledge of propeller and about the performance of propoller

TEXT BOOKS:

1. John D. Anderson," Aircraft performance and design", Tata McGraw hill publications, Sixth Edition, 2014.
2. Houghton, E.L., and Carruthers, N.B.," Aerodynamics for engineering students", Edward Amold Publishers, Fifth Edition, 2013.

REFERENCES:

1. L.J.Clancy, “Aerodynamics”, Pitman, Eleventh Edition, 2015.
2. Kuethe, A.M., and Chow, C.Y., “Foundations of Aerodynamics”, John Wiley &Sons, Second Edition, 2007.
3. AC Kermode, “Flight without Formula”, McGraw hill, Fifth Edition, 2013

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Apply the knowledge of Basics of Flight Performance under various conditions to Aircraft industry.	3	1		3	2	3	1	3						1	
Co2	Understand the various climbing and turning performance of the aircraft.	3	1		3	2	3	1	3						1	
Co3	Analyze the condition for minimum drag and minimum power in an aircraft.	3	1		3	2	3	1	3						1	
Co4	Build the knowledge of the propeller and about the performance of the propoller	3	1		3	2	3	1	3						1	
Co5	Build the knowledge of propeller and about the performance of propoller		2		3	2	3	1	3						1	

518AET03 **Aerodynamics II**

L	T	P	C
3	0	0	3

PRE-REQUISITE :- Knowledge of Aerodynamics-I

COURSE OBJECTIVE

The Students will be able to

a) Understand the behavior of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows.
b) Analyze the various concepts of shockwaves and Expansion waves
c) Study the High Speed flows in airfoils with Critical Mach numbers and Characteristics of wings
d) Describe different types of Wind tunnels with shock tubes for flow visualization
e) To study the high speed wind tunnels and classification of tunnels

UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW **9 Periods**

Energy, Momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various back pressures.

UNIT II NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES **9 Periods**

Prandtl equation and Rankine – Hugonoit relation, Normal shock equations, Pitot statictube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations, Hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, two dimensional supersonic nozzle contours.

UNIT III DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS **9 Periods**

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl- Glauert affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

UNIT IV AIRFOIL IN HIGH SPEED FLOWS **9 Periods**

Lower and upper critical Mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

UNIT V HIGH SPEED WIND TUNNELS **9 Periods**

Blow down, in draft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities, Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.

` **TOTAL: 45 Periods**

COURSE OUTCOMES:

Upon completion of the course, students are able to

a) Categorize the behavior of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows.
b) Compare the various concepts of shockwaves and Expansion waves
c) Apply the knowledge for High Speed flows in airfoils with Critical Mach numbers
d) Understand the different types of Wind tunnels with shock tubes
e) To understand high speed wind tunnels and its classification

TEXT BOOKS:

1. Rathakrishnan, E., “Gas Dynamics”, Prentice Hall of India, Sixth Edition, 2013.
2. John D Anderson Jr “Compressible flow” Tata McGraw hill Publication, Eighth Edition, 2014

REFERENCES:

1. Shapiro, A.H., “Dynamics and Thermodynamics of Compressible Fluid Flow”, Ronold Press, 2012.
2. Zucrow, M.J. and Anderson, J.D., “Elements of gas dynamics”, McGraw-Hill Book Co., New York, 2009.
3. John D Anderson Jr “Introduction to Flight” Tata McGraw hill Publication, Eighth Edition, 2014

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Categorize the behavior of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows.	3	3		3	2	3	1	3		2		3		1	
Co2	Compare the various concepts of shockwaves and Expansion waves	3	3	2	2	2	3	1	3			2			1	2
Co3	Apply the knowledge for High Speed flows in airfoils with Critical Mach numbers	3	3	2	3	2	2	1	3	1					1	3
Co4	Understand the different types of Wind tunnels with shock tubes	3	3		3	2	3	1	2		2		3		2	
Co5	To understand high speed wind tunnels and its classification	3	2		3	2	3	1	3			3	2		1	

518AET04 **PROPULSION II**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

The Students will be able to

a) Understand the necessary background of the Aircraft Propulsion and Rocket propulsion systems
b) Study the application of various propellant systems and their properties
c) Learn the Various propulsion system, Performances and Advantages of those systems
d) Categorize different types of propulsion systems and concepts applied in nozzle propulsion
e) To understand the advanced propulsion systems and its types of propulsion system

UNIT I GAS TURBINES **9 Periods**

Impulse and reaction blading of gas turbines – Velocity triangles and power output Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor – Numerical problems.

UNIT II RAMJET AND SCRAMJET PROPULSION: **9 Periods**

Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram- rocket- Numerical problems.

UNIT III ROCKET PROPULSION **9 Periods**

Operating principle – Specific impulse of rocket – internal ballistics- Rocket nozzle classification – Rocket performance considerations – Liquid Cooling, Ablative cooling, Film cooling, Solid Propellants, Liquid Propellants - Numerical Problems.

UNIT IV CHEMICAL ROCKETS **9 Periods**

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets – Limitations of hybrid rockets – Relative advantages of liquid rockets over solid rockets- Numerical Problems.

UNIT V ADVANCED PROPULSION SYSTEMS **9 Periods**

Electric rocket propulsion System – Ion propulsion System – Nuclear rocket propulsion System – Nuclear Thermal rocket Types – Solar sail- Preliminary Concepts in nozzle less propulsion.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Learn the concept Aircraft and Rocket propulsion systems
b) Classify the applications of various propellant systems and their properties
c) Analyze various propulsion systems, Performances and Advantages and apply the knowledge in Propulsion field.
d) Classify different types of propulsion systems and concepts applied in nozzle propulsion
e) Understand the types of propulsion and advance propulsion system

TEXT BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition. 2014.
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 2nd illustrated reprint edition, 2012.

RE**FERENCES**

1. H. Cohen, G. F. C, Rogers, and H. I. H. Saravana muttoo, *Gas Turbine Theory*, Pearson Education India, 2011.
2. David r. Greatrix, "powered flight: the engineering of aerospace propulsion", springer science & business media, illustrated edition ,2012

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn the concept Aircraft and Rocket propulsion systems	3	1		3	2	3	1	3		1				1	
Co2	Classify the applications of various propellant systems and their properties	3	1	1	3	2	3	1	3			3			1	
Co3	Analyze various propulsion systems, Performances and Advantages and apply the knowledge in Propulsion field	3	2		3	2	3	2	3	2			3		3	
Co4	Classify different types of propulsion systems and concepts applied in nozzle propulsion	3	1		3	2	3	2	2			1	1		1	2
Co5	Understand the types of propulsion and advance propulsion system	3	2		3	2	3	1	3		2				1	2

518AEP07 **Aircraft Structures Lab II**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Determine the Bending in Symmetric and Unsymmetrical Sections
b) Find the shear center location for open and closed sections
c) Conduct Experiment on photo elastic techniques and vibration of beams
d) Test flexibility matrix for cantilever beam and Beam with combined loading
e) Find the elastic materials and stresses in circular, beams using photo elastic techniques
f) Determine the measurement of vibration of beams and tension field beam experiment

LIST OF EXPERIMENTS

1. Determination of Unsymmetrical bending of different materials using bend test set up.
2. Determination of Shear center location for open sections
3. Determination of Shear center location for closed sections
4. Experiment on Constant strength beam
5. Finding out flexibility matrix for cantilever beam
6. Testing of Beam with combined loading
7. Calibration of Photo- elastic materials
8. Determination of Stresses in circular discs and beams using photo elastic techniques
9. Measurement of Vibrations of beams
10. Wagner beam – Tension field beam experiments.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Find the Bending in Symmetric and Unsymmetrical Sections
b) Compute the shear center location for open and closed sections
c) Calculate the Stress values of photo elastic techniques and vibration of beams
d) Analyze the Experiments on flexibility matrix for cantilever beam and Beam with combined loading
e) Calculate the elastic material of calibration of photo and beams (photo elastic techniques)
f) Analyze the vibration of beams and tension field beams

LIST OF EQUIPMENTS

(for a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	Unsymmetrical sections like 'Z' sections	2	1, 2, 3
2.	Channel section and angle section	2	1, 2, 3
3.	Dial gauges	10	1, 2, 3
4.	Weights 1Kg	12	1, 2, 3
5.	Weights 2 Kg	10	1,2,3
6.	Beam Test Set – up	2	1, 2, 3
7.	Strain indicator and strain gauges	One set	4,5,6
8.	Photo – elastic apparatus	1	7,8
9.	Amplifier	2	9
10.	Exciter	2	9
11.	Oscilloscope	2	9
12.	Wagner beam set up	1	10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Find the Bending in Symmetric and Unsymmetrical Sections	3	1		3	2	3	1	3	1			2		1	
Co2	Compute the shear center location for open and closed sections	3	1		2	1	2	1	3			3			1	
Co3	Calculate the Stress values of photo elastic techniques and vibration of beam	3	1		3	2	2	1	3	2				3	2	1
Co4	Analyze the Experiments on flexibility matrix for cantilever beam and Beam with combined loading	3	2	2	3	2	3	2	2		2				2	
Co5	Calculate the elastic material of calibration of photo and beams (photo elastic techniques)		2		3	2	3	1	2		1		2		1	3
Co6	Analyze the vibration of beams and tension field beams	3			3	2	3	1	3			2			1	

518AEP08 **Propulsion laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE:

The Students will be able to

a) Understand the basic concepts of aero engines and carry out experiments on diffusers
b) Estimate the Performance of a propellers
c) Determine the Velocity in free jet and wall jet set up
d) Analyze the Flow visualization of water flow channel
e) Understand the basic concepts of aircraft piston engine and jet engine

List of Experiments:

1. Study of an aircraft piston engine (includes study of assembly sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (includes study of assembly of sub systems, various components, their functions and operating principles
3. Performance of 2d diffuser a) Stable Flow b) Separated flow
4. Determine the performance of a propeller
5. Determination of heat of combustion of aviation fuel
6. Combustion performance studies in a duct (duct burner)
7. Determine the Velocity measurements in free jet set up
8. Determine the Velocity measurements in wall jet set up
9. Flow visualization of water flow channel

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Apply the knowledge of Engine operations in Aeronautical field
b) Analyze the Performance of Propellers
c) Calculate the velocity of free jet and wall jet experiments and Apply in Industrial applications
d) Make use of Flow visualization and categorize the flow based on Reynolds number.
e) Determining the heat of combustion of aviation fuel.

List of Equipment:

(For a batch of 36 students)

S. No	Equipment	Quantity	Experiment No
1	Piston Engine	1	1
2	Jet Engine	1	2
3	2D Diffuser	1 (separated flow) & 1(stable flow)	3
4	Axial Turbine Blade Row Model (with pressure tapping)	1	4
5	Axial compressor Blade Row Model (with pressure tapping)	1	4
6	Water tube manometers with 20 channels	1	9
7	Propeller Model	1	4
8	2D Traverse Mechanism	1	3, 4
9	Free Jet Test Setup	1	7

10	Aluminum Plates with wall static pressure turbine	1	8
11	Bomb Calorimeter	1	5, 6
12	Duct Burner	1	6
13	Compressor (5 bar)	1	1, 2

Course Outcome		**PSO 1**	**PSO 2**	**PSO 3**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
Co1	Apply the knowledge of Engine operations in Aeronautical field	3	1		3	2	3	1	3						1	
Co2	Analyze the Performance of Propellers	3	1		3	2	3	1	3						1	
Co3	Calculate the velocity of free jet and wall jet experiments and Apply in Industrial applications	3	1		3	2	3	1	3						1	
Co4	Make use of Flow visualization and categorize the flow based on Reynolds number	3	1		3	2	3	1	3						1	
Co5	Determining the heat of combustion of aviation fuel		2		3	2	3	1	3						1	

518AEE05 **Aircraft Rules and Regulation**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

The Students will be able to

a) Understand the civil air rules and regulations which are being followed by Directorate General of Civil Aviation.
b) Learn about the maintenance certification for the airworthiness of the aircraft.
c) Gain the knowledge on basics of airworthiness and certification and health monitoring
d) Analyze Flight evaluation and Testing Procedures

UNIT I AIRWORTHINESS AND PROCEDURE **9 Periods**

Responsibilities of operators / owners- Procedure of CAR issue, amendments. Objectives and targets of airworthiness directorate; Airworthiness regulations and safety oversight of engineering activities of operators list.

UNIT II AIRCRAFT MAINTENANCE **9 Periods**

Investigation, analysis, rectification and defect reporting and monitoring Analytical study of in-flight readings& recordings; Maintenance control by reliability Method. Aircraft maintenance programmer& their approval; Maintenance of fuel and oil uplift and consumption records – Light aircraft engines; Fixing routine maintenance periods– Initial & revisions.

UNIT III AIRWORTHINESS AND CERTIFICATION **9 Periods**

Air worthiness and continued air worthiness ,Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness.

UNIT IV HEALTH AND USAGE MONITORING **9 Periods**

On condition of AME License, its classification, experience requirements, Mandatory, Modifications / Inspections. On condition maintenance of reciprocating engines;

UNIT V FLIGHT EVALUATION **9 Periods**

Flight testing of aircraft, Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Use furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit; Procedure for issue of type approval of aircraft components and equipment including instruments.

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a.) Apply the knowledge of Airworthiness regulations and CAR procedures which are being followed by DGCA.
b.) Understand the Issuing of Airworthiness certificate and its requirements of aircraft
c.) Clear analysis of aircraft maintenance.
d.) Determine the Flight evaluation and Testing Procedures techniques for further applications
e.) Classification of maintenance of reciprocating engines

TEXT BOOKS

1. "Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2013.
2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.

REFERENCES

1. "Aircraft Manual (India) Volume" – Latest Edition, the English Book Store, 17-1Connaught Circus, New Delhi 2013.
2. Brimmd.j. boggesh, "aircraft maintenance", pitman publishing corp. New york, 2013
3. Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Ed. Stephens R.W.B., Chapman and Hall, 2006.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply the knowledge of Airworthiness regulations and CAR procedures which are being followed by DGCA	3	1		3	2	2	1	3		2		3		1	
Co2	Understand the Issuing of Airworthiness certificate and its requirements of aircraft	3	1	2	3	2	2	1	3	2			2		1	3
Co3	Clear analysis of aircraft maintenance	3	1		3	2	3	1	3			1			1	2
Co4	Determine the Flight evaluation and Testing Procedures techniques for further applications	3	1		3	2	3	1	3		2		3		1	
Co5	Classification of maintenance of reciprocating engines	3	2		3	2	3	1	3	2					1	

518AEE06 **Airlines Operations and Management**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Understand the Different Airline Operations and Air transport management
b) Know the Planning of Airport and Air safety Management
c) Gain the knowledge on basics of Air traffic and Flight rules.
d) Describe the Aircraft Management Safety Standards Guidelines

UNITI AIR TRANSPORT MANAGEMENT **9 Periods**

Air Transport – Basics – Advantages – Air Transportation in India – Civil Aviation Department – Airport Terminology – Components Parts of Aeroplane – Characteristics of Aircraft and Jet Aircraft – Civil and Military Aircrafts – Classification of Airports – Flying Activities – Airport Surveys – Objectives and Types of Surveys – Drawings to be Prepared

UNIT II AIRPORT PLANNING AND MANAGEMENT **9 Periods**

Airport Planning – Improvement of Existing Airport - Site Selection – Airport Size – Forecasting in Aviation – Zoning Laws – Regional Planning – Airport Architecture – Environmental Considerations – Factors influenced by Airport Activity – Runway Design – Runway Orientation – Runway Length – Airport Capacity – Runway Patterns.

UNIT III AVIATION MANAGEMENT **9 Periods**

Introduction to Aviation Management – Aviation – Aviation Sector in India - Civil Aviation – Airport – Air Traffic Control – Flight Data Recorder – Airline – Case Study

UNITIV AIR SAFETY MANAGEMENT **9 Periods**

Air Safety – FAA Aviation Safety Draft Documents – Aircraft Management Interagency Committee for Aviation Policy Safety Standards – Aircraft Management Safety Standards Guidelines for Federal Flight Programmes – National Transportation Safety Board – Airline Water Supplies – JFIM

UNIT V AIRLINE OPERATIONS **9 Periods**

Air Traffic Control – Importance – Flight Rules – Air Traffic Control Network – Ari Traffic Control Aids – Automation in Air Traffic Control Aids – Heliports and Stolports – Advantages, Characteristics, Planning of Heliports – Elevated Heliports – Heliports at Airport – Characteristics and Advantages of STOL Aircraft – Planning of Stolports

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Learn the Different Airline Operations and Air transport management.
b) Understand the Planning of different Airport and Air safety Management
c) Apply the knowledge of Air traffic control and Flight rules in aviation field
d) Identify the Aircraft Management Safety Standards Guidelines and Apply to the respective issues.
e) Breif knowledge about FAA aviation safety and aviation policy safety

TEXT BOOKS

1. Ratandeep Singh, “Aviation Management”, Kanishka Publishers, 2012
2. Rangwala, “Airport Engineering”, 7th Edition, Charotar Publishing House, 2007

REFERENCES

1. "Kathleen M. Sweet, "Aviation and Airport Security", Pearson Education, 2014
2. "Aircraft Manual – Volume 1 and Volume 2", Sterling Book House.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn the Different Airline Operations and Air transport management	2	1		3	2	3	1	3			3			1	
Co2	Understand the Planning of different Airport and Air safety Management	3	1		3	2	1	1	3		1		1		1	
Co3	Apply the knowledge of Air traffic control and Flight rules in aviation field	2	2	1	2	2	1	2	2				2		2	2
Co4	Identify the Aircraft Management Safety Standards Guidelines and Apply to the respective issues	3	1	1	1	2	3	1	3	2		3			1	3
Co5	Breif knowledge about FAA aviation safety and aviation policy safety	3	2		3	2	3	1	3		1		2		1	

518AEE07 **Aero-Engine Testing and Performance Evaluation**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The students are able to

a) Understand the Testing of Turbo engines and Evaluation
b) Know the Importance of Combustor, Propellers and Nozzles in Aircraft Industry
c) Gain knowledge about Engine performance and quality testing
d) Analyze the Performance of air breathing engines and Wind tunnel tests

UNIT I COLD FLOW TESTING **9 Periods**

Need For Gas Turbine Engine Testing and Evaluation, Philosophy of Testing, Rationale of Testing. Types of tests: Proof of Concepts, Design Verification, Design Validation, and Formal Tests. Aero Thermodynamic Tests: Compressor: Compressor scaling parameter Groups, Compressor MAP. Inlet distortions. Surge margin stack up. Testing and Performance Evaluation, Test rig.

UNITII HOT FLOW TESTING **9 Periods**

Combustor MAP, Pressure loss, combustion light up test. Testing and Performance Evaluation. Aero Thermodynamic Tests: Turbines: Turbine MAP. Turbine Testing and Performance Evaluation. Component model scaling. Inlet duct & nozzles: Ram pressure recovery of inlet duct. Propelling nozzles, after burner, maximum mass flow conditions. Testing and Performance Evaluation.

UNIT III ENGINE PERFORMANCE **9 Periods**

Design & off-design Performance. Transient performance. Qualitative characteristics quantities. Transient working lines. Starring process & Wind milling of Engines. Thrust engine start envelope. Calculations for design and off-design performance from given test data – (case study for a Jet Engine).

UNIT IV QUALIFICATION TEST **9 Periods**

Tests used to evaluate a design. Environment ingestion capability. Preliminary flight rating tests, Qualification testing, acceptance tests, Reliability figure of merit. Structural integrity tests: Design Verification Tests, Durability and Life Assessment Tests, Reliability Tests, Failure Simulation Tests, Functional and Operability Tests. Types of engine tests: Normally Aspirated Testing, Ram Air Testing, Altitude Testing, Flying Test Bed, Mission Oriented Tests, Open Air Test Bed, Ground Testing of Engine Installed in Aircraft, Flight testing.

UNIT V PERFORMANCE EVALUATION **9 Periods**

Air breathing engine test facility. Direct connect altitude cell, propulsion wind tunnels. Types of engine test beds. Factors for design of engine test beds. Altitude test facility. Steps in test bed cross calibration. Engine testing with simulated inlet distortions. Surge test. Cell Calibration and Correction. Performance Reduction Methodology. Instrumentation: Data Acquisition, Measurement of Thrust, Pressure, Temperature, Vibration, etc. Accuracy and Uncertainty in Measurements. Experimental Stress Analysis.

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Apply the knowledge in Testing of Turbo engines and Evaluation
b) Analyze the Combustion chamber, Propellers and Nozzles in Aircraft Industry
c) Know about the Engine performance and quality testing in Aircrafts
d) Develop the knowledge of Performance of air breathing engines and Wind tunnel tests
e) Brief case study of a jet engine

TEXT BOOKS

1. P.P Walsh and P. Peletcher, Gas Turbine Performance, Blackwell Science, 2014, ISBN 0632047843.
2. J P Holman, Experimental methods for Engineers, Tata McGraw –Hill Publishing Co. Ltd .,2007

REFERENCES

1. Advance Aero-Engine Testing, AGARD-59 Publication
2. NASA CR-1997,`An inventory of Aeronautical Ground Research Facilities.
3. MIL –5007 E , `Military Specifications: Engine , Aircraft, Turbo Jet & Turbofan General Specification for Advance Aero Engine testing`, 15th Oct 2003.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Apply the knowledge in Testing of Turbo engines and Evaluation	3	1		3	1	3	1	3		2		1		1	
Co2	Analyze the Combustion chamber, Propellers and Nozzles in Aircraft Industry	3	1		2	2	3	1	3	2			3		1	3
Co3	Know about the Engine performance and quality testing in Aircrafts	3	1		2	2	2	1	3		2		3		2	
Co4	Develop the knowledge of Performance of air breathing engines and Wind tunnel tests	3	2		3	1	3	1	3	1				3	2	
Co5	Brief case study of a jet engine	3	2		3	2	2	1	3			1			1	3

518AEE08 **Aircraft Quality and Assurance**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Understand the Quality concepts in aircraft industry
b) Know the Importance of Quality control and Designing of Quality
c) Gain the knowledge of Reliability Prediction and Manufacturing of Quality Assurance
d) Define the Probability Concepts and Scope for data analysis

UNIT I QUALITY CONCEPTS AND ASSURANCE **9 Periods**

Concepts and definition, design specifications, manufacture in conformance with design applications, role of quality assurance during usage of aircraft.

Quality assurance during overall / repair of aircraft and its aggregates, concession and deviations. Production permits.

UNIT II QUALITY CONTROL AND DESIGNING OF QUALITY **9 Periods**

Units of measure, measuring actual performance. Continuous process regulation. Strategic quality management. Role of quality director. Quality culture.

Early warning concepts and design assurance. Designing for basic function requirements. Design for Time- Oriented performance. Designing for safety. Designing for maintainability.

UNIT III PROBABILITY CONCEPTS **9 Periods**

Concept of variation. Quantitative methods of summarizing data. Normal curve, Exponential Probability distribution. Weibull probability distribution. Poisson distribution. Binomial distribution. Scope for data analysis. Sample size. Regression analysis.

UNIT IV MANUFACTURE & RELIABILITY PREDICTION **9 Periods**

Initial planning for qualities. Failure patterns. Predicting reliability during design. Exponential formula. Setting specification limits. Process quality audits. Self-inspection

UNIT V INSPECTION AND QUALITY ASSURANCE **9 Periods**

Sampling risk. Analysis of some rule to thumb. Sampling plot. Evaluation of parameters affecting field performance. Acceptance sampling plan. Feed back . Field data.

Zero defect analogy, FMECA, Fault Tree Analysis, bench marking, quality circles, quality audit. Quality standards ISO 9000, TQM, CMM, Six Sigma. Quality organizational set up in production / repair / operational set up.

Total: 45 Periods

COURSE OUTCOMES

Upon completion of this course, students will be able to

a) Apply the knowledge of Quality concepts in aircraft industry
b) Describe the Importance of Quality control and Designing of Quality
c) Define about knowledge of Reliability Prediction and Manufacturing of Quality Assurance
d) Analyze the Concepts of Probability and Scope for data analysis
e) Clarification of inspection and quality assurance.

TEXT BOOKS

1. J M Juran, Frank M Gryna, 'Quality Planning and Analysis,' TMH Publications, 2005 124
2. MIL –5007 E , `Military Specifications: Engine , Aircraft, Turbo Jet & Turbofan General Specification for Advance Aero Engine testing`, 15th Oct 1973.

REFERENCES

1. Advance Aero-Engine Testing, AGARD-59 Publication 2000
2. NASA CR-1875,`An inventory of Aeronautical Ground Research Facilities. Publication 2002

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply the knowledge of Quality concepts in aircraft industry	3	1		3	2	3	1	3		2		3		1	
Co2	Describe the Importance of Quality control and Designing of Quality	3	1	2	3	1	1	1	3					2	1	
Co3	Define about knowledge of Reliability Prediction and Manufacturing of Quality Assurance	3	2		2	2	3	1	3	2		1			2	
Co4	Analyze the Concepts of Probability and Scope for data analysis	3	1	3	3	2	3	1	3		1	3			1	2
Co5	Clarification of inspection and quality assurance		2		3	2	3	1	3				3		1	

518AEE09 **Space Flight Mechanics**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The Students are able to

a) Study the basic concepts of Solar system and Earth atmosphere.
b) Describe the Satellite operations and Satellite Injections
c) Understand the concept of Interplanetary Trajectories and Missile Trajectories
d) Know the materials used in space craft and Effect of Space Environment on the Selection of Spacecraft Material

UNIT I BASIC CONCEPTS **9 Periods**

The Solar System – References Frames and Coordinate Systems – The Celestial Sphere – The Ecliptic – Motion of Vernal Equinox – Sidereal Time – Solar Time – Standard Time – The Earth's Atmosphere.

UNIT II THE GENERAL N-BODY PROBLEM **9 Periods**

The many body Problem – Lagrange – Jacobian Identity –The Circular Restricted Three Body Problem – Libration Points- Relative Motion in the N-body Problem –Two –Body Problem – Satellite Orbits – Relations Between Position and Time – Orbital Elements.

UNIT III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS **9 Periods**

General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell's Method – Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

UNIT IV INTERPLANETARY TRAJECTORIES **9 Periods**

Two Dimensional Interplanetary Trajectories –Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if Interplanetary Spacecraft – Trajectory about the Target Planet.

UNIT V BALLISTIC MISSILE TRAJECTORIES AND MATERIALS **9 Periods**

The Boost Phase – The Ballistic Phase –Trajectory Geometry- Optimal Flights – Time ofFlight – Re – entry Phase – The Position of the Impact Point – Influence Coefficients. Space Environment – Peculiarities – Effect of Space Environment on the Selection of Spacecraft Material

TOTAL: 45 Periods

COURSE OUTCOME

Upon successful completion of the course, students will be able to

a) Define the Basic concepts of Solar system and Earth atmosphere.
b) Analyze the Satellite operations and Satellite Injections
c) Understand the concept of Interplanetary Trajectories and Missile Trajectories
d) Differentiate the Space craft materials and Selection of Spacecraft Material
e)

TEXT BOOK:

1. Cornelisse, J.W., "Rocket Propulsion and Space Dynamic", W.H. Freeman & Co., 2014.
2. Tom Logsdon "Orbital mechanics". Wiley Publications, October 2012

REFERENCES:

1. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley, 2013.
2. Van de Kamp, P., “Elements of Astro mechanics”, Pitman, 2009.
3. Parker E.R., “Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.
4. “Space vehicle design” AIAA series 2000 edition

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Define the Basic concepts of Solar system and Earth atmosphere	3	1		3	2	3	1	3						1	
Co2	Analyze the Satellite operations and Satellite Injections	3	1		3	2	3	1	3						1	
Co3	Understand the concept of Interplanetary Trajectories and Missile Trajectories	3	1		3	2	3	1	3						1	
Co4	Differentiate the Space craft materials and Selection of Spacecraft Material	3	1		3	2	3	1	3						1	
Co5			2		3											

518AEE10 **Aircraft Control Engineering**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Understand the Feedback control systems and representation of control systems.
b) Define the basic concepts of Mechanical and electrical components, Development of flight Control systems.
c) Learn the Characteristic Equation and Functions of control system with Sample data Systems.
d) Analyze the concept of stability, bode techniques with frequency response

UNIT I INTRODUCTION **9 Periods**

Historical review – Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies –Mechanical and electrical components, Development of flight control systems.

UNIT II OPEN AND CLOSED LOOP SYSTEMS **9 Periods**

Feedback control systems – Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios, Signal flow graph.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS **9 Periods**

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

UNIT IV CONCEPT OF STABILITY **9 Periods**

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

UNIT V SAMPLED DATA SYSTEMS **9 Periods**

Introduction to digital control system, Digital Controllers and Digital PID Controllers.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students are able to

(a) Describe the Feedback control systems and representation of control systems
(b) Analyze the basic concepts of Mechanical and electrical components with the Development of flight
Control systems
(c) Apply the knowledge of Characteristic Equation and Functions of control system with Sample data Systems An ability to understand the aircraft stability analysis.
(d) Learn the concept of stability, bode techniques with frequency response

Text Books

1. Ogato, Modern Control Engineering, Prentice – Hall of India Pvt. Ltd. New Delhi, 2013.
2. M. Gopal, Control Systems, Principles and design – Tata McGraw-Hill Publication, New Delhi, 2014.

References

1. J. J. D. Azzo and C. H. Houpis, Feedback control system analysis and synthesis, McGraw – Hill
   International, 6th Edition, 2014.
2. B. C. Kuo, Automatic control systems, Prentice – Hall of India Pvt. Ltd., New Delhi, 2012.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Describe the Feedback control systems and representation of control systems	3	1		3	2	3	1	3						1	
Co2	Analyze the basic concepts of Mechanical and electrical components with the Development of flight Control systems	3	1		3	2	3	1	3						1	
Co3	Apply the knowledge of Characteristic Equation and Functions of control system with Sample data Systems An ability to understand the aircraft stability analysis	3	1		3	2	3	1	3						1	
Co4	Learn the concept of stability, bode techniques with frequency response	3	1		3	2	3	1	3						1	
Co5			2		3	2	3	1	3						1	

518AEE11 **Unmanned Aircraft Systems**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Understand the historical evolution of Unmanned Aircraft Systems
b) Study Basic Aerodynamics and Design Considerations of Unmanned Aircraft Systems
c) Learn the concept of Stability control and Surveillance.
d) Analyze the Propulsion systems of unmanned aerial vehicle

UNIT I INTRODUCTION TO UNMANNED AERIAL SYSTEM **9 Periods**

Introduction, History, Overview of UAV System, Types of UAV, Air vehicle, Mission planning and Control station, Launch and Recovery equipment's, Payloads, Ground control stations, Types of UAV.

UNIT II BASIC AERODYNAMIC OF UNMANNED AERIAL SYSTEM **9 Periods**

Basic Aerodynamic Equations, Aircraft Polar, The real wing and airplane, induced drag, Boundary layer, flapping wings, Total Air vehicle drag.

UNIT III DESIGN CONSIDERATIONS OF UNMANNED AERIAL SYSTEM **9 Periods**

UAV Design Considerations, Characteristics of Design Parameters, wing types and tendencies, fuselage design, power plant design, payload options, forces acting on UAV, Range and Endurance, Classification of Flight control. Construction Techniques.

UNIT IV STABILITY AND CONTROL **9 Periods**

Stability- Longitudinal, Lateral and Dynamic. Aerodynamic Control – Pitch control, Lateral Control, Auto pilots. Sensor, Actuator, Airframe Control. Climbing Flight, Gliding Flight. Static and Dynamic Loads.

UNIT V PROPULSION AND SURRIVELLANCE **9 Periods**

Thrust Generation, Powered Lift, Sources of Power, Types of engines- Two Cycle Engine, Rotary Engine, Gas Turbine Engine, Electric Power Engine. Imaging Sensor, Target Detection, Process of Searching, Considerations in Surveillance, Controlling the Machine.

TOTAL 45 Periods

COURSE OUTCOME

On successful completion of the course student should be able to

a) Understand the historical evaluation of Unmanned Aircraft Systems in Aeronautical Engineering Development
b) Design the Unmanned Aircraft Systems by considering all design parameters and able to stabilize the Unmanned Aircraft Systems
c) Apply the Unmanned Aircraft Systems in the field of Surveillance
d) Learn the Propulsion systems of unmanned aerial vehicle

TEXT BOOKS

1. Paul Fahlstrom, Thomas Gleason. Introduction to UAV Systems, 4th Edition. Wiley Publication 2012 ISBN: 978-1-119-97866-4
2. Douglas M. Marshall, Richard K. Barnhart Et all, Introduction to Unmanned Aircraft Systems, CRC Press, 2016.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Understand the historical evaluation of Unmanned Aircraft Systems in Aeronautical Engineering Development	3	1		3	2	3	1	3						1	
Co2	Design the Unmanned Aircraft Systems by considering all design parameters and able to stabilize the Unmanned Aircraft Systems	3	1		3	2	3	1	3						1	
Co3	Apply the Unmanned Aircraft Systems in the field of Surveillance	3	1		3	2	3	1	3						1	
Co4	Learn the Propulsion systems of unmanned aerial vehicle	3	1		3	2	3	1	3						1	
Co5			2		3	2	3	1	3						1	

518AEE12 **Introduction to Wind Tunnel Techniques** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

The Students are able to

a) Develop the necessary background for understanding basic concepts of measurement of forces and moments on models during the wind tunnel testing.
b) Understand the application of various types of wind tunnels.
c) Learn the basic measurement procedure involving wind tunnel testing and to understand nature flow over the various components.
d) Calculate the wind tunnel measurement and Analyze different types of wind tunnels

UNIT I INTRODUCTION **9 Periods**

Introduction to different models, types of testing, Buckingham Theorem – Non-Dimensional Numbers –Scale Effect Types of Similarities.

UNIT II WIND TUNNELS **9 Periods**

Classification – Special problems of testing in Subsonic, Transonic, supersonic and hypersonic speed regions Layouts – sizing and design parameters.

UNIT III CALIBRATION OF WIND TUNNELS **9 Periods**

Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT IV WIND TUNNEL MEASUREMENTS **9 Periods**

Pressure and velocity measurements – Force measurements – Three component and six component balances Internal balances.

UNIT V FLOW VISUALIZATION **9 Periods**

Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TOTAL 45 Periods

COURSE OUTCOME

On successful completion of this course, students are able to

a) Define the basic concepts of measurement of forces and moments on models during the wind tunnel testing.
b) Analyze the application of various types of wind tunnels.
c) Develop the skills about measurement procedure involving wind tunnel testing and to understand nature flow over the various components.
d) Classify wind tunnel measurement and Analyze different types of wind tunnels

TEXT BOOKS

1. Rae, W.H. and Pope, A. “Low Speed Wind Tunnel Testing”, John Wiley Publication, 1999.

2. R.C.Pankhurst and D.W.Holder, “Wind Tunnel Technique”, Sir Isaac Pitman & Sons Ltd, First Published, 1952.

REFERENCE BOOKS

1. Pope, A., and Goin, L., “High Speed wind Tunnel Testing”, John Wiley, 1999.

2. P.Bradshaw.B.A, “Experimental Fluid Mechanics”, Pergamon Press, the MacMillan Company, New York, 1999.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Define the basic concepts of measurement of forces and moments on models during the wind tunnel testing	3	1		3	2	3	1	3						1	
Co2	Analyze the application of various types of wind tunnels	3	1		3	2	3	1	3						1	
Co3	Develop the skills about measurement procedure involving wind tunnel testing and to understand nature flow over the various components	3	1		3	2	3	1	3						1	
Co4	Classify wind tunnel measurement and Analyze different types of wind tunnels	3	1		3	2	3	1	3						1	
Co5			2		3	2	3	1	3						1	

518AEE13 **Fundamentals of Flight**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Define Basic properties and Basic terminologies of the Aircraft
b) Learn the performance characteristic of propeller and jet propulsion systems
c) Understand Different types of aircraft systems and apply the methods for estimating performance of aircraft
d) Know the Basics of Aerodynamics and Apply in further studies

UNIT I INTRODUCTION TO PRINCIPLES OF FLIGHT **9 Periods**

Physical properties and structure of the atmosphere, temperature, pressure and altitude relationships, evolution of lift, drag and moment. Airfoils, Mach number and maneuvers.

UNIT II INTRODUCTION TO AIRPLANE STRUCTURES & MATERIALS **9 Periods**

General types of construction, Monocoque, semi-monocoque and geodesic construction, typical wing and fuselage structure. Metallic and non-metallic materials, use of aluminum alloy, titanium, stainless steel and composite materials.

UNIT III POWER PLANTS USED IN AIRPLANES& SPACECRAFTS **9 Periods**

Basic ideas about piston, turboprop and jet engines, use of propeller and jets for thrust production. Comparative merits, principles of operation of rocket, types of rockets and typical applications, exploration into space.

UNIT IV AIRCRAFT SYSTEMS **9 Periods**

Hydraulic systems - Study of typical workable system - components - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification

UNIT V BASICS OF AERODYNAMICS **9 Periods**

Properties of fluids, Type of fluid flows, Generation of Lift, Drag and Moment, Incompressible flows over airfoils, calculation of lift and drag from measured pressure distribution, Streamlined and bluff-body, Reynolds number and Mach number, Conservation law of mass and momentum, Euler and Bernoulli's equations, pitot-tube measurement of airspeed .Pressure coefficient. Streamlines, path lines and streak lines. Angular velocity, vorticity, circulation Stream function, velocity potential and their relationship.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students are able to

a) Describe the concept of Basic properties and Basic terminologies of the Aircraft
b) Know about the performance characteristic of propeller and jet propulsion systems
c) Learn Different types of aircraft systems and apply the methods for estimating performance of aircraft
d) Apply the Knowledge of Basic aerodynamics to Aircrafts

TEXT BOOKS

1. J. D. Anderson, Introduction to Flight, fifth edition McGraw-Hill, 2011.
2. A.C. Kermode, Flight without Formulae, McGraw-Hill, 2005.

REFERENCE BOOKS

1. R. S. Shevell, Fundamentals of Flight, Pearson Education, 2006
2. Richard O,Reinhart .M.D basic flight physiology, Third edition, McGraw-Hill,2007
3. T. M. G. Megson, Aircraft Structures for Engineering Students, fifth edition, 2013.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Describe the concept of Basic properties and Basic terminologies of the Aircraft	3	1		3	2	3	1	3						1	
Co2	Know about the performance characteristic of propeller and jet propulsion systems	3	1		3	2	3	1	3						1	
Co3	Learn Different types of aircraft systems and apply the methods for estimating performance of aircraft	3	1		3	2	3	1	3						1	
Co4	Apply the Knowledge of Basic aerodynamics to Aircrafts	3	1		3	2	3	1	3						1	
Co5			2		3	2	3	1	3						1	

518AEE14 **Introduction to Space Systems**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Students are able to

a) Understand the basic concept of control systems with mathematical modeling and Sub systems.
b) Study the basic concepts of Time response analysis and steady state analysis.
c) Analyze Hydraulic and Pneumatic Systems
d) Learn the concept of Missiles and Trajectories

UNIT I INTRODUCTION TO SPACE SYSTEMS **9 Periods**

The Solar System - Space Flight History – Space environment, – Space environment Models, Space crafts, Sidereal Time – Solar Time – Standard Time – The Earth's Atmosphere.

UNIT II THE SPACE SUB-SYSTEMS DESIGN **9 Periods**

Fundamentals of Mission Analysis and Design, Structure and Mechanism Subsystem Design, Propulsion Subsystem Design**,** Attitude Control Subsystem Design, Power Subsystem Design, Thermal Control Subsystem Design, Command and Data Handling Subsystem Design, Communication Subsystem Design

UNIT III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS **9 Periods**

General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell's Method – Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

UNIT IV INTERPLANETARY TRAJECTORIES **9 Periods**

Two Dimensional Interplanetary Trajectories –Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if Interplanetary Spacecraft – Trajectory about the Target Planet.

UNIT V BALLISTIC MISSILE TRAJECTORIES AND MATERIALS **9 Periods**

The Boost Phase – The Ballistic Phase –Trajectory Geometry- Optimal Flights – Time of Flight – Re – entry Phase – The Position of the Impact Point – Influence Coefficients. Space Environment – Peculiarities – Effect of Space Environment on the Selection of Spacecraft Material.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able

a) Know about various orbits and orbit deviations
b) Learn the basic concept of control systems with mathematical modeling and Sub systems.
c) Analyze planet and target planets and their trajectories
d) Define about the concepts of Time response analysis and steady state analysis.

TEXT BOOKS

1. Charles D. Brown, Elements of Spacecraft Design, AIAA Educational Series, Reston, VA, American Institute of Aeronautics and Astronautics, Inc., ©2002.
2. Paluszek, Michael, et. al., Spacecraft Attitude and Orbit Control, 2nd edition, Princeton Satellite Systems, 2009.

REFERENCE BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley,7th edition,2007.
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1980.
3. Parker E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1988

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Know about various orbits and orbit deviations	3	1		3	2	3	1	3						1	
Co2	Learn the basic concept of control systems with mathematical modeling and Sub systems	3	1		3	2	3	1	3						1	
Co3	Analyze planet and target planets and their trajectories	3	1		3	2	3	1	3						1	
Co4	Define about the concepts of Time response analysis and steady state analysis	3	1		3	2	3	1	3						1	
Co5			2		3	2	3	1	3						1	

518AEP09 **Aircraft Structures Repair Lab**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Conduct Experiment on Patch repair work by using composites
b) Weld the given Material by using TIG and MIG welding setup
c) Make use of sandwich panels for Aircraft industry
d) Use Sheet Metals for Aircraft Body development and other works

LIST OF EXPERIMENTS

1. Patch repair welding using TIG.
2. Patch repair welding using MIG.
3. Patch repair welding using Plasma Arc.
4. Experiment on pipe bending
5. Experiment on Riveted joints & repair work.
6. Experiment on composites & repair work.
7. Repair of Sandwich panels.
8. Exercise on Sheet metal forming.
9. Exercise on cable swaging

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Learn Patch repair work by using composites
b) Analyze the Weld for the given Material by using TIG and MIG welding setup
c) Use of sandwich panels for Aircraft industry
d) Know the use of Sheet Metals for Aircraft Body development and other works

LIST OF EQUIPMENTS

(For a batch of 36 students)

S.No	Details of Equipments	Qty Req.	Experiment No.
1.	Shear cutter pedestal type	1	6,8
2.	Drilling Machine	1	5,6,8
3.	Bench Vices	1	5,6,8
4.	Radius Bend bars	1	4
5.	Pipe Flaring Tools / Pipe Bending Tools	1	9
6.	Carbide Gas Plant	1	3
7.	MIG Weld Plant	1	2
8.	TIG Weld Plant	1	1
9.	Plasma welding setup	1	3
10.	Cable And Swaging Block	1	9
11.	Sandwich / Composite Panels	5	6,7

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn Patch repair work by using composites	3	1		3	2	3	1	3						1	
Co2	Analyze the Weld for the given Material by using TIG and MIG welding setup	3	1		3	2	3	1	3						1	
Co3	Use of sandwich panels for Aircraft industry	3	1		3	2	3	1	3						1	
Co4	Know the use of Sheet Metals for Aircraft Body development and other works	3	1		3	2	3	1	3						1	

518AEP10 **MAT Lab**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Understand the basic principles of programming and of implementing mathematical concepts in MATLAB
b) Find the Variables and constants by Simple Calculations of MAT LAB
c) Conduct Experiment on Matrix Operations and Functions in MATLAB
d) Write numerical algorithms and evaluate the computational results using graphical representations

LIST OF EXPERIMENTS

1. MATLAB basics - The MATLAB environment - Basic computer programming
2. MATLAB toolboxes - Variables and constants, operators and simple calculations - Formulas and functions
3. Matrices and vectors - Matrix and linear algebra review - Vectors and matrices in MATLAB
4. Matrix operations and functions in MATLAB
5. Computer programming - Algorithms and structures
6. MATLAB scripts and functions (m-files) - Simple sequential algorithms - Control structures (if…then, loops)
7. MATLAB programming - Reading and writing data, file handling - Personalized functions - Toolbox structure - MATLAB graphic functions
8. Numerical simulations - Numerical methods and simulations - Random number generation – Monte carlo methods

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Learn basic principles of programming and of implementing mathematical concepts in MATLAB
b) Compute the Variables and constants by Simple Calculations of MAT LAB
c) Do the Experiment on Matrix Operations and Functions in MATLAB
d) Analyze numerical algorithms and evaluate the computational results using graphical representations

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	MAT LAB & Simulink Software	10 License	1 to 8
2.	Computers of configuration 4 gb ram, Dual Core Processor, 320 HD.	36	1 to 8

1. MATLAB Getting Started Guide

- http://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf Useful references:
- MATLAB Central (script, toolbox, blog, newsgroup)
- http://www.mathworks.com/matlabcentral/ MATLAB Newsletters
  http://www.mathworks.com/company/newsletters/

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn basic principles of programming and of implementing mathematical concepts in MATLAB	3	1		3	2	3	1	3						1	
Co2	Compute the Variables and constants by Simple Calculations of MAT LAB	3	1		3	2	3	1	3						1	
Co3	Do the Experiment on Matrix Operations and Functions in MATLAB	3	1		3	2	3	1	3						1	
Co4	Analyze numerical algorithms and evaluate the computational results using graphical representations	3	1		3	2	3	1	3						1	

518AEP11 **Computer Aided Modeling And Analysis Laboratory** **L T P C**
0 0 2 1

COURSE OBJECTIVE

The Students will be able to

a) Understand the basic principles of Computer Aided Modeling and Analysis by using Ansys software
b) Determine the Stresses analysis in 2D and 3D problems
c) Find the Conduction and Convection Boundary Conditions for Thermal Analysis.
d) Conduct experiment on Fluid flow Analysis - Potential distribution in the 2 - D bodies

LIST OF EXPERIMENTS

1) Bars of constant cross section area, tapered cross section area and stepped bar
2) Trusses- (Minimum 2 exercises)
3) Beams - Simply supported, cantilever. beams with UDL, beams with varying load.etc (Minimum 6 exercises)
4) Stress analysis of a rectangular plate with a circular hole
5) Thermal Analysis - 2D problem with conduction and convection boundary conditions (Minimum 2 exercises)
6) Fluid flow Analysis - Potential distribution in the 2 - D bodies
7) Fixed- fixed beam for natural frequency determination Dynamic Analysis
8) Bar subjected to forcing function- Fixed- fixed beam subjected to forcing function

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Conduct Experiments on the Meshed models and to correct the meshing volumes
b) Analyze the Stresses analysis in 2D and 3D problems
c) Compute the Conduction and Convection Boundary Conditions for Thermal Analysis.
d) Do experiment on Fluid flow Analysis - Potential distribution in the 2 - D bodies

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
3.	Ansys Version 14 Software	10 License	1 to 8
4.	Computers of configuration 4 gb ram, Dual Core Processor, 320 HD.	36	1 to 8

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Conduct Experiments on the Meshed models and to correct the meshing volumes	3	1		3	2	3	1	3						1	
Co2	Analyze the Stresses analysis in 2D and 3D problems	3	1		3	2	3	1	3						1	
Co3	Compute the Conduction and Convection Boundary Conditions for Thermal Analysis	3	1		3	2	3	1	3						1	
Co4	Do experiment on Fluid flow Analysis - Potential distribution in the 2 - D bodies	3	1		3	2	3	1	3						1	

518AEP12 **Hypermesh Laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Understand the basic principles of meshing and Discretization of solid models.
b) Mesh the Two dimensional model
c) Generate the Meshing for Three dimensional model
d) Analyze the Meshed models and to correct the meshing volumes

LIST OF EXPERIMENTS

1) Two dimensional model meshing
   a) Mesh the given circular plate with a hole.
   b) Mesh the given I Section, L Section and T Section.
   c) Mesh the given Plate with a Hole and Hexagon
   d) Mesh the given Plate with a Hole, Hexagon and Ellipse

2) Three Dimensional Meshing
   a) Mesh the given Clip Repair model
   b) Mesh the given Car model
   c) Mesh the given Aircraft Model
   d) Mesh the given Bracket Model with Riveting

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Define the basic principles of meshing and Discretization of solid models.
b) Develop the Mesh of Two dimensional model
c) Understand the concept of Meshing for Three dimensional model
d) Conduct Experiments on the Meshed models and to correct the meshing volumes
e) Understand the concepts of two dimensional and three dimensional meshing.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	Hypermesh 12 Software	10 License	1 to 2
2.	Computers of configuration 4 gb ram, Dual Core Processor, 320 HD.	36	1 to2

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Define the basic principles of meshing and Discretization of solid models	3	1		3	2	3	1	3						1	
Co2	Develop the Mesh of Two dimensional model	3	1		3	2	3	1	3						1	
Co3	Understand the concept of Meshing for Three dimensional model	3	2		2	3	3	1	2						1	
Co4	Conduct Experiments on the Meshed models and to correct the meshing volumes	3	1		3	2	3	1	3						2	
Co5	Understand the concepts of two dimensional and three dimensional meshing		2		2	2	3	1	3						1	

518AEP13 **Aircraft System Control**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Understand the basic principles of Aircraft Operation and control techniques
b) Find and rectify the problems in hydraulic and fuel systems.
c) Conduct Experiment on Flow tests and Maintenance of Aircraft
d) Test The pressure and Brake load in Aircraft

LIST OF EXPERIMENTS

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

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Understand the basic principles of Aircraft Operation and control techniques
b) Clear the problems in hydraulic and fuel systems.
c) Do Experiment on Flow tests and Maintenance of Aircraft
d) Analyze The pressure and Brake load in Aircraft
e) Clear analysis about control systems in the aircraft.

LIST OF EQUIPMENTS

(For a batch of 36 students)

S.No	Items	Quantity	Experiment No.
1	aircraft systems (Fuel System, Brake System)	1	1,2,3,4,5,6,7,8,9,10
2	Hydraulic Jacks (Screw Jack)	5	4 and 5
3	Trestle adjustable	5	1,2,4,8
4	Spirit Level	2	1,2,4,8
5	Levelling Boards	2	8
6	Cable Tensiometer	1	8
7	Adjustable Spirit Level	1	8
8	Plumb Bob	1	8

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understand the basic principles of Aircraft Operation and control techniques	3	1		3	2	3	1	3						1	
Co2	Clear the problems in hydraulic and fuel systems.	3	1		3	2	3	1	3						1	
Co3	Do Experiment on Flow tests and Maintenance of Aircraft	3	1		3	2	3	1	3						1	
Co4	AnalyzeThe pressure and Brake load in Aircraft	3	1		3	2	3	1	3						1	
Co5	Clear analysis about control systems in the aircraft		2		3	2	3	1	3						1	

618AET01	Composite Materials and Structures	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Know the various composite materials and structures used in aircraft Applications and their test methods.
b) Understand the effect of sandwich construction in the aircraft materials and its prevention methods.
c) Knowing about the sandwich construction process and failure modes
d) Learn the various open and closed mould processes and fabrication process.
e) Learn the process of metal matrix and composite material and its applications

UNIT I INTRODUCTION TO COMPOSITE MATERIALS **9 Periods**

Introduction to Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. Applications: Automobile, Aircrafts missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

UNIT II MICRO AND MACRO ANALYSIS OF COMPOSITES **9 Periods**

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems. Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix.

UNIT III SANDWICH CONSTRUCTIONS **9 Periods**

Basic design concepts of sandwich construction -Materials used for sandwich construction – Failure modes of sandwich panels.

UNIT IV FABRICATION PROCESS **9 Periods**

Layup and curing, fabricating process, open and closed mould process, hand lay-up techniques; structural laminate bag moulding, production procedures for bag moulding; filament winding, pultrusion, pulforming, thermo-forming, injection moulding, blow moulding.

UNIT V METAL MATRIX COMPOSITES & CERAMIC COMPOSITES **9 Periods**

Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application. Fabrication Process for MMC's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques. Ceramic composites & its Applications.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Apply the various composite materials and structures used in aircraft Applications and their test methods.
b) Learn simple micromechanics and failure modes of composites.
c) Analyse the effect sandwich construction in the aircraft materials and its prevention methods.
d) Learn the various open and closed mould processes, fabrication process.
e) Construct the methods of manufacturing and analysis of different composite technique.

TEXT BOOKS

1. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 2012.

2. Krishnan K Chawla “Mechanics of Composite Materials”, McGraw-Hill. 2011.

REFERENCE BOOKS

1. Agarwal, B.D., and Broutman, L.J., “Analysis and Performance of Fibre Composites”, John Wiley and sons. Inc., New York, 2010.
2. Lubin, G., “Handbook on Advanced Plastics and Fibre Glass”, Von Nostrand Reinhold Co., New York, 2011.
3. Calcote, L R. “The Analysis of laminated Composite Structures”, Von – Noastrand Reinhold Company, New York 2008.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Apply the various composite materials and structures used in aircraft Applications and their test methods. .	**2**	**1**		**3**	**2**	**3**	**1**					**1**		**1**	
Co2	Learn simple micromechanics and failure modes of composites.	**3**	**1**		**3**	**2**	**3**	**1**		**2**					**1**	
Co3	Analyse the effects sandwich construction in the aircraft materials and its prevention methods. .	**3**	**1**		**3**	**2**	**3**	**1**			**1**				**1**	
Co4	Learn the various open and closed mould processes, fabrication process.	**3**	**1**		**3**	**2**	**3**	**1**							**1**	
Co5	Construct the methods of manufacturing and analysis of different composite technique.		**2**		**3**	**2**	**3**	**1**							**1**	

618AET02	Heat Transfer	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Know basic study of the phenomena of heat transfer.
b) Develop a knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation.
c) Account for the consequence of heat transfer in thermal analyses of engineering systems.
d) The radiative heat transfer that should be learnt in detailed
e) Heat exchangers and heat transfer in aerospace engineering

UNIT I HEAT CONDUCTION **9 Periods**

Basic Modes of Heat Transfer – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces – Unsteady state. Heat Conduction: Lumped System Analysis – Heat Transfer in Semi-infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.

UNIT II CONVECTIVE HEAT TRANSFER **9 Periods**

Review of basic equations of fluid flow – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

UNIT III RADIATIVE HEAT TRANSFER **9 Periods**

Basic definitions – concept of black body -Irradiation – total and monochromatic quantities - Laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann – laws of black body radiation-radiation between black surfaces –Radiation shape factors – Radiation shields.

UNIT IV HEAT EXCHANGERS **9 Periods**

Classification–Temperature Distribution–Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method. Mechanics of fins and its operations.

UNIT V HEAT TRANSFER PROBLEMS IN AEROSPCAE EGINEERING **9 periods**

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Derive the equation for temperature distribution in fins, to estimate the rate of heat transfer through conduction through slabs, cylindrical and spherical surface objects.
b) Knowledge about the rate of heat transfer and heat transfer coefficients for forced and free convection Heat transfer problems.
c) Evaluate the radiant heat transfer between solid bodies, black or gray.
d) Perform the LMTD & NTU analysis to the heat exchanger problems, to analyze and design the boiling heat transfer problems.
e) Apply heat transfer principles (conduction, convection and radiation) in solving aerospace engineering problems that are related to heat transfer.

TEXT BOOKS

1. Yunus A. Cengel., “Heat Transfer – A practical approach”, Second Edition, Tata McGraw-Hill, 2002.
2. Nag. P.K., “Heat and Mass Transfer”, Tata McGraw-Hills Co., Ltd.-2015,

REFERENCE BOOKS

1. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., Third Edition 2008.
2. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 8th Edn., 1997.
3. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1997.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Derive the equation for temperature distribution in fins, to estimate the rate of heat transfer through conduction through slabs, cylindrical and spherical surface objects.	**2**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Knowledge about the rate of heat transfer and heat transfer coefficients for forced and free convection Heat transfer problems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**			**1**			**1**	
Co3	Evaluate the radiant heat transfer between solid bodies, black or gray	**3**	**2**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Perform the LMTD & NTU analysis to the heat exchanger problems, to analyze and design the boiling heat transfer problems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**	**1**					**1**	
Co5	Apply heat transfer principles (conduction, convection and radiation) in solving aerospace engineering problems that are related to heat transfer.	**2**	**2**		**3**	**2**	**3**	**1**	**3**						**1**	

618AET03 **Experimental Stress Analysis**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Knowledge about measuring instruments, factors affecting measurements, errors and corrective measurements.
b) Impart a brief introduction to the emerging techniques like digital image correlation.
c) Study about NDT, Radiography, ultrasonic, magnetic particle inspection, acoustic emission technique, holography, thermograph, fiber optic sensor.
d) Boosting knowledge about photoelasticity of two and three dimensions
e) The fundamentals of non destructive testing and thermograhy

UNIT I MEASUREMENTS **9 Periods**

Introduction to Measuring Instruments, Principles of measurements, Types of Measuring Instruments, Factors affecting measurements, Errors in measurements and corrective actions. Accuracy, Sensitivity and range of measurements.

UNIT II EXTENSOMETERS **9 Periods**

Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT III ELECTRICAL RESISTANCE STRAIN GAUGES **9 Periods**

Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV PHOTOELASTICITY **9 Periods**

Two dimensional photo elasticity, Concept of light – photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT V NON – DESTRUCTIVE TESTING **9 Periods**

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiber – optic Sensors.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Understood the Measuring instruments; factors affecting measurements, errors and corrective measurements
b) Demonstrate the principles of different types of extensometers.
c) Analyze the principles of rosettes and gather the requirements of the Strain gauges.
d) Get knowledge about photo elasticity, stress optic law, compensation and separation techniques, interpretation of fringe pattern.
e) Understand NDT, Radiography, ultrasonic, magnetic particle inspection, acoustic emission technique, holograph techniques were studied.

TEXT BOOKS

1. Thomas G. Beckwith, Maragoni, Lienhard (2009), Mechanical Measurements, 6th edition, Pearson Education, New Delhi.
2. Sadhu Singh. “Experimental Stress Analysis”, Khanna Publishers 2009.

REFERENCE BOOKS

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw-Hill, New Delhi, 1991.
2. Hetyenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1988.
3. Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw-Hill Inc. New York, 2005, 4th edition.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understood the Measuring instruments; factors affecting measurements, errors and corrective measurements	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Demonstrate the principles of different types of extensometers.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co3	Analyze the principles of rosettes and gather the requirements of the Strain gauges.	**2**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Get knowledge about photo elasticity, stress optic law, compensation and separation techniques, interpretation of fringe pattern.	**3**	**1**		**3**	**2**	**1**	**2**	**3**						**1**	
Co5	Understand NDT, Radiography, ultrasonic, magnetic particle inspection, acoustic emission technique, holograph techniques were studied	**1**	**2**		**3**	**2**	**3**	**1**	**2**						**1**	

618AET04	Finite Element Analysis	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Understand the concept of numerical analysis of structural components.
b) Utilize of FEA as Engineering solution tool to problems (both vector and scalar) involving various fields for Design Analysis and Optimization.
c) Impart knowledge on both ANSYS, NASTRAN.
d) understanding the concept of one and two dimensional problems
e) The concepts should be understand about the axisymmetric continuum and case studies.

UNIT I INTRODUCTION **9 Periods**

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNIT II ONE DIMENSIONAL PROBLEMS **9 Periods**

Finite element modelling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III TWO DIMENSIONAL CONTINUUM **9 Periods**

Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects

UNIT IV AXISYMMETRIC CONTINUUM **9 Periods**

Axis-symmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – applications to cylinders under internal or external pressures – Rotating discs

UNIT V CASE STUDIES BY USING ANSYS AND NASTRON **9 Periods**

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axis-symmetric problems.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Understood the approximate analytical methods in FEA and concept of numerical analysis of structural components.
b) Analyze the mathematical models for physical system using principle of minimum potential energy / principle of Virtual Work
c) Acquired the finite element attributes, types, different types of boundary Conditions and interpolation functions. (2D & 3D)
d) Application of FEA to simple bars, Truss, Beam and Isoperimetric Element Formulation.
e) Derive global stiffness matrix for triangular plane and they will analyses using ANSYS.

TEXT BOOKS

1. Rao S.S., "The Finite Element Method in Engineering", Butterworth-Heinemann, fourth edition, 2011.
2. J. N. Reddy "An Introduction to the Mathematical Theory of Finite Elements" Courier Corporation, 2012.

REFERENCE BOOKS

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering" Pearson Education 2002, 3rd Edition.
2. David V Hutton, Fundamentals of Finite Element Analysis, TATA McGraw-Hill Publishing Company, Limited, 2005.
3. Robert D.Cook., David's, Malkus Michael E Plesha, "Concepts and Applications of Finite Element Analysis" Ed. Wiley, 2003.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understood the approximate analytical methods in FEA and concept of numerical analysis of structural components	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the mathematical models for physical system using principle of minimum potential energy / principle of Virtual Work	**3**	**1**		**3**	**2**	**3**	**1**	**2**		**1**				**1**	
Co3	Acquired the finite element attributes, types, different types of boundary Conditions and interpolation functions. (2D & 3D)	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co4	Application of FEA to simple bars, Truss, Beam and Isoperimetric Element Formulation.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Derive global stiffness matrix for triangular plane and they will analyses using ANSYS.	**3**	**2**		**3**	**2**	**3**	**1**	**3**				**2**		**1**	

618AEP07 **Aircraft Design Lab**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The students will be able to

a) Compare different configuration of airplanes on Specifications and performance details of aircraft.
b) Prepare comparative data sheets and compare different graph and selection of main parameters for the aircraft design.
c) Calculate the preliminary weight estimations, power plant selection, airfoil selection, wing tail and control surfaces.
d) Estimate the load of the aircraft design.
e) Analysis the design of the aircraft and testing.

LIST OF EXPERIMENTS

1. To study and Construct V-n diagram for the design study
2. Gust and manoeuvrability envelopes
3. Critical loading performance and final V-n graph calculation
4. Structural design study – Theoretical approach
5. Load estimation of wings and fuselage.
6. Balancing and Manoeuvring loads on tail plane, Aileron and Rudder loads.
7. Detailed structural layouts
8. Design of any two components of wings, fuselage
9. Preparation of a detailed design report with CAD drawings.
10. Any one Proto type model of UAV

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Based upon the mission of the aircraft the students designated for a collection of data are collected from different aircraft having the same mission.
b) Analyze the main design parameter for the aircraft design.
c) Knowledge about the approximate weight of the aircraft that they design by specifying the different types of weight of the aircraft, the types of power plant selected as well as aero foil selection and tail empennage.
d) Evaluate the overall drag of the newly designed aircraft for further calculation on performance of the aircraft.
e) The aircraft analysis should be clarified with the exact graph results and calculations

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Based upon the mission of the aircraft the students designated for a collection of data are collected from different aircraft having the same mission.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the main design parameter for the aircraft design	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Knowledge about the approximate weight of the aircraft that they design by specifying the different types of weight of the aircraft, the types of power plant selected as well as aero foil selection and tail empennage.	**3**	**1**	**1**	**2**	**2**	**3**	**2**	**3**						**1**	
Co4	Evaluate the overall drag of the newly designed aircraft for further calculation on performance of the aircraft	**3**	**1**		**3**	**2**	**3**	**2**	**3**						**1**	
Co5	The aircraft analysis should be clarified with the exact graph results and calculations	**1**	**3**		**3**	**2**	**3**	**1**	**3**						**1**	

618AEP08 **Material Testing Lab**

L	T	P	C
0	0	2	1

PRE-REQUISITES: Knowledge of strength of materials is required.

COURSE OBJECTIVE

The students will be able to

a) Knowledge about the basic principles of strength of materials to the undergraduate students through a series of experiments.
b) Understand the fatigue endurance limit or fatigue life and fatigue strength of the materials.
c) Basic concept of testing of materials under untreated and heat treated conditions.
d) Know the failure modes and usage of destructive and nondestructive testing techniques of engineering materials.
e) Understanding the concept of non destructive testing and various types of NDT

LIST OF EXPERIMENTS PART-A

1. Tension test on mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Impact test on metal specimen
4. Creep testing of materials
5. Fatigue test on mild steel and Aluminium rods
6. Flexural testing on composite materials

PART-B

7. Preparation of specimen for metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & metal matrix composites
8. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
9. To study the wear characteristics of ferrous, non-ferrous and composite material for different parameters.
10. Non-Destructive test experiments like,
    a. Ultrasonic flaw detection.
    b. Magnetic crack detection.
    c. Dye penetrant testing, to study the defects of casted and welded specimens.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Acquired the knowledge to perform various mechanical testing.
b) Analyze the microstructure of various engineering materials.
c) Knowledge of performing various non-destructive tests.
d) Describe structures of metallic materials and their effects on mechanical properties.
e) understanding the basic cocepts of aluminium rods of fatigue.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipment's	Qty Required	For Experiments
1.	Universal Testing Machine	1	1
2.	shear testing machine	1	2
3.	Impact Testing Machine	1	3
4.	Creep testing machine	1	4
5.	fatigue testing machine	1	5
6.	Flexural testing machine	1	6
7.	Scanning Electron Microscopy (SEM/EDS)	1	7
8.	Wear testing machine	1	8
9.	Portable induction heat treatment machine	1	9
10.	NDT Equipment's (Defect scope, Dye-penetrant method, Hot oil Chalk Method, Ultrasonic, Magnetic)	1 each	10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Acquired the knowledge to perform various mechanical testing.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze the microstructure of various engineering materials	**3**	**1**	**1**	**3**	**2**	**3**	**1**	**3**						**1**	
Co3	. Knowledge of performing various non-destructive tests	**2**	**1**		**2**	**2**	**3**	**1**	**3**						**1**	
Co4	Describe structures of metallic materials and their effects on mechanical properties.	**3**	**1**	**1**	**3**	**2**	**3**	**1**	**3**						**1**	
Co5	understanding the basic cocepts of aluminium rods of fatigue	**1**	**2**		**3**	**2**	**3**	**1**	**3**						**1**	

618AEP05 **Theory of Elasticity**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the Equations of equilibrium for types of dimensional bodies
b) Understand the plane strain problems
c) Learn about the torsion based theory.
d) learn the stress strain problems.
e) study the theory of Navier , Prandals theory and polar co ordinates

UNIT I INTRODUCTION OF ELASTICITY **9 Periods**

Definitions- notations and sign conventions for stress and strain, Equations of equilibrium for two dimensional bodies and three dimensional bodies. Numerical problems.

UNIT II BASIC EQUATIONS OF ELASTICITY **9 Periods**

Strain – displacement relations, Stress – strain relations, Lame's constant – cubical dilation, Compressibility of material, bulk modulus, Shear modulus, Compatibility equations for stresses and strains, Principal stresses and principal strains, Mohr's circle, Saint Venant's principle.

UNIT III PLANE STRESS AND PLANE STRAIN PROBLEMS **9 Periods**

Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams, etc.

UNIT IV POLAR COORDINATES **9 Periods**

Equations of equilibrium, Strain displacement relations, Stress – strain relations, Axi symmetric problems, Kirsch, Michell's and Boussinesque problems.

UNIT V TORSION **9 Periods**

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, the semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of course, students will able to

a) Understood the Compatibility equations for stresses and strains

b) Describe the Numerical problems in assumption of elasticity.

c) Study the Equations of equilibrium for types of dimensional bodies

d) Understood the Kirsch, Michell's and Boussinesque problems.

e) Describe about the Plane stress and Strain

TEXT BOOK

1. Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw–Hill Ltd. Tokyo, 2007.
2. Enrico Volterra& J.H. Gaines, "Advanced Strength of Materials", Prentice Hall New Jersey, 1991.

REFERENCES

1. "Elasticity-Theory and Numerics" Martin Sadd.Kindle Edition, 2004.
2. "Advanced Strength and Applied Elasticity", Ugural and Fenster 2001.
3. "Advanced strength of materials", L. S. Srinath 2006.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understood the Compatibility equations for stresses and strains	**3**	**1**		**3**	**2**	**1**	**1**	**3**						**1**	
Co2	Describe the Numerical problems in assumption of elasticity	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Study the Equations of equilibrium for types of dimensional bodies	**3**	**1**		**3**	**2**	**2**	**1**	**3**						**1**	
Co4	**Understood the** Kirsch, Michell's and Boussinesque problems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Describe about the Plane stress and Strain		**1**		**3**	**2**	**1**	**1**	**3**						**1**	

618AEE06 **Intellectual Property Rights**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the introduction of IPR
b) Understand the procedures of patents
c) Learn about the case study of IPR
d) knowing the strategies of IPR
e) understand the concept of patents and copyrights.

UNIT I INTRODUCTION **9 Periods**

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).

UNIT II PATENTS **9 Periods**

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III ESTABLISHMENT OF WIPO **9 Periods**

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV STRATEGIES **9 Periods**

Indian Position Vs. WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES **9 Periods**

Case Studies on – Patents (Basmati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

Total: 45 Periods

COURSE OUTCOME

Upon completion of course, students will able to

a) Understood the commitments to WTO
b) Describe the General Agreement on Trade and Tariff
c) Study the strategies of Indian IPR legislations
d) Understood the Protection against unfair competition.
e) Describe about the types of property

TEXT BOOKS

1. Subbaram N.R. “Handbook of Indian Patent Law and Practice “, S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
2. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.

REFERENCES

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001.
3. V K Ahuja “law relating to intellectual property rights” 2016.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understood the commitments to WTO	**3**	**1**		**3**	**2**	**1**	**1**	**2**		**1**				**1**	
Co2	Describe the General Agreement on Trade and Tariff	**3**	**2**		**1**	**2**	**3**	**1**	**3**						**1**	
Co3	Study the strategies of Indian IPR legislations	**3**	**1**		**3**	**2**	**3**	**1**	**3**	**1**					**1**	
Co4	Understood the Protection against unfair competition	**3**	**1**		**3**	**2**	**1**	**1**	**2**						**1**	
Co5	Describe about the types of property		**1**		**3**	**2**	**2**	**1**	**3**						**1**	

618AEE07 **Wind Tunnel Techniques**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the principles of model testing
b) Understand the calibration of wind tunnels
c) Learn about the techniques in Flow Visualization
d) Learn about Instrumentation of wind tunnels and measurements
e) Understand the concepts of flow visualization.

UNIT I INTRODUCTION OF WIND TUNNELS **9 Periods**

Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT II PRINCIPLES OF MODEL TESTING **9 Periods**

Introduction to different models, types of testing, Buckingham Theorem – Non-Dimensional Numbers –Scale Effect Types of Similarities

UNIT III CALIBRATION OF WIND TUNNELS **9 Periods**

Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT IV INSTRUMENTATION AND MEASUREMENTS, DATA ACTUATING SYSTEMS **9 Periods**

Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances.

UNIT V FLOW VISUALIZATION TECHNIQUES **9 Periods**

Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of course, students will able to

a) Understood about the Test section speed
b) Describe about the wind tunnel measurements
c) Study the flow visualization in wind tunnel techniques
d) Understand the Calibration of supersonic tunnels.
e) Describe about the model testing in wind tunnel

TEXT BOOKS

1. Rae, W.H. and Pope, A. “Low Speed Wind Tunnel Testing”, John Wiley Publication, 2004.
2. R.C.Pankhurst and D.W.Holder, “Wind Tunnel Technique”, Sir Isaac Pitman & Sons Ltd, First Published, 2001.

REFERENCES

1. Pope, A., and Goin, L., “High Speed wind Tunnel Testing”, John Wiley, 2007.
2. John.J.Harper, “Low Speed Wind Tunnel Testing”, John Wiley Publication, 2001.
3. P.Bradshaw.B.A, “Experimental Fluid Mechanics”, Pergamon Press, The MacMillan Company, New York, 2000.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understood about the Test section speed	**3**	**1**		**3**	**3**	**3**	**1**	**3**						**1**	
Co2	Describe about the wind tunnel measure-ment	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Study the flow visualization in wind tunnel techniques	**2**	**1**		**3**	**2**	**3**	**2**	**3**						**1**	
Co4	**Understand the** Calibration of supersonic tunnels	**3**	**1**		**3**	**1**	**3**	**1**	**1**			**2**			**1**	
Co5	Describe about the model testing in wind tunnel	**3**	**2**		**3**	**2**	**3**	**1**	**1**			**2**			**1**	

618AEE08 **Boundary Layer Theory**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Understand the concepts of Navigation and guidance.
b) Learn Aerospace vehicles and flight control system.
c) Analyze the performance of control techniques in aerospace system.
d) Learning the concepts of control techniques of rockets and missiles.
e) Understand the process of the control systems of the space crafts.

UNIT I NAVIGATION **9 Periods**

Introduction, Basic Principles and Definitions; Dead reckoning and Position Fixing, Celestial, Radio, Inertial Navigation; Principle and Construction of Accelerometers, Mechanical Gyros and Ring Laser Gyros, Inertial Measurement Units, Navigation Equations, Sensor Error Models, Kalman Filter, Attitude Heading Reference System, GPS, Terrain Reference Navigation

UNIT II GUIDANCE **9 Periods**

Optimal Terminal Guidance of Interceptors, Optimal Terminal Guidance - planar and non-planar, Robust and Adaptive Guidance, Guidance with State Feedback , Guidance with Normal Acceleration Input , Minimum Energy Orbital Transfer

UNIT III AIRCRAFT CONTROLS **9 Periods**

Powered Flying Controls, Helicopter Flight Controls, Fly-by-Wire Flight Control, Control laws, Redundancy and Failure Survival, Digital Implementation, Fly-by-Light Flight Control, Auto Pilot, Flight Management Systems, Unmanned Aerial Vehicles

UNIT IV CONTROL TECHNIQUES OF ROCKETS AND MISSILES **9 Periods**

Open-loop and Closed Loop Control Systems, Multi-variable Optimization, Optimal Control of Dynamic Systems, Hamiltonian and Minimum Principle and Jacobi-Bellman Equation, Linear Time-Varying System with Quadratic Performance Index, Closed-Loop Attitude Control, Roll Control System, Pitch Guidance and Control System of Rockets, Adaptive Pitch Control System, Yaw Control of Rockets, Guidance and Control of Missiles

UNIT V CONTROL OF SPACECRAFT **9 Periods**

Launch of Satellite Spacecraft, Terminal Control of Spacecraft Attitude, Optimal Single-Axis Rotation of Spacecraft, Multi-axis Rotational Maneuvers of Spacecraft, Spacecraft Control Torques, Rocket Thrusters, Reaction Wheels, Momentum Wheels and Control Moment Gyros, Torques - Magnetic Field -Environmental -Gravity-Gradient.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Gain the basic principles of navigation system.
b) Understanding the control position of orbital Transfer under guidance system.
c) Analyze the various control system techniques and its performance.
d) Relate the control systems and guidance and control of launch vehicles.
e) Knowledge about injection of satellite Spacecraft control techniques.

TEXT BOOKS

1. Tewari, A. " Advanced Control of Aircraft, Spacecraft and Rockets", John Wiley & Sons, Ltd, Chi Chester, UK, 2011
2. R.P.G Collinson, "Introduction to Avionics Systems", Springer; 3rd ed. edition, 2011.

REFERENCES

1. Noton, M. “Spacecraft navigation and Guidance”, Springer-Verlag, Germany, 1998.
2. Richard H. Battin “An Introduction to the Mathematics and Methods of Astrodynamics”, AIAA, 1999.
3. Nagrath. M. and Gopal. I.J. “Control Systems Engineering”, Wiley eastern Ltd...2001.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Gain the basic principles of navigation system	**3**	**1**		**3**	**2**	**2**	**1**	**2**						**1**	
Co2	Understanding the control position of orbital Transfer under guidance system	**3**	**1**		**3**	**2**	**3**	**2**	**3**						**1**	
Co3	Analyze the various control system techniques and its performance	**3**	**1**		**3**	**2**	**2**	**2**	**1**						**1**	
Co4	Relate the control systems and guidance and control of launch vehicles.	**3**	**1**		**3**	**2**	**3**	**1**	**1**						**1**	
Co5	Knowledge about injection of satellite Spacecraft control techniques.		**2**		**3**	**2**	**3**	**2**	**1**		**1**				**1**	

618AEE09 **Flight Testing**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the various flight testing methods and their sequence
b) Understand the stability and control
c) Learn the performance flight testing
d) Knowledge of the take off lading turning flight.
e) Understand the concept of stability control.

UNIT I INTRODUCTION **9 Periods**

Purpose and scope of flight testing, basic definition, types of flight tests, sequence of flight testing, planning the test program, governing regulations. Aircraft weight and center of gravity, flight testing tolerances. Method of reducing data uncertainty in flight test data -sources and magnitudes of error, avoiding and minimizing errors.

UNIT II FLIGHT TEST INSTRUMENTATION **9 Periods**

Planning flight test instrumentation, sensing and transuding techniques. Measurement of linear and angular displacements, velocities and accelerations, vibration, force, temperature - onboard and ground based data acquisition system. Radio telemetry.

UNIT III PERFORMANCE FLIGHT TESTING - RANGE, ENDURANCE AND CLIMB **9 Periods**

Airspeed – in flight calibration. Level flight performance for propeller driven aircraft and for Jet aircraft - Techniques and data reduction. Range and endurance estimation of propeller and jet aircraft. Climb performance methods.

UNIT IV PERFORMANCE FLIGHT TESTING -TAKE-OFF, LANDING, TURNING FLIGHT **9 Periods**

Turning performance limitations. Drag estimation. Take-off and landing -methods, procedures and data reduction. Flight test Methods:-Static longitudinal stability; Dynamic longitudinal stability. Data reduction. Maneuvering stability methods & data reduction.

UNIT V STABILITY AND CONTROL - LATERAL & DIRECTIONAL **9 Periods**

Flight Test methods: - Lateral and directional static stability; Lateral and directional dynamic stability. Regulations and data reduction. Stall and spin- regulations, test and recovery techniques. Dive testing for flutter, vibration and buffeting.

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of course, students will able to

a) Understood the Level flight performance in aircraft testing
b) Describe the Flight Test methods in Stability & Control
c) Study the take-off, landing, turning flight methods in Performance flight testing
d) Understood the Dive testing for flutter, vibration and buffeting.
e) Describe about the Maneuvering stability methods & data reduction.

TEXT BOOKS

1. Ralph D Kimberlin, `Flight Testing of Fixed Wing Aircraft`, AIAA educational Series, 2003.
2. Barnes W.McCormick `Introduction to Flight Testing and Applied Aerodynamics`2009

REFERENCES

1. ADARD, Flight Test Manual Vol. I to IV
2. Mr. Mark J. Mondt II `The Tao of Flight Test & Principles` 2009
3. Albert Edward Dixie "Air navigation for pilots" 2015.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	.Understood the Level flight performance in aircraft testing	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co2	Describe the Flight Test methods in Stability & Control	**2**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co3	Study the take-off, landing, turning flight methods in Performance flight testing	**3**	**1**		**3**	**2**	**3**	**1**	**1**						**1**	
Co4	Understood the Dive testing for flutter, vibration and buffeting.	**3**	**1**		**2**	**2**	**3**	**1**	**1**						**1**	
Co5	Describe about the Maneuvering stability methods & data reduction.	**2**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	

618AEE10 **Aircraft Electronics Microprocessor**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study about the various trouble shooting digital circuits in aircraft systems.
b) Understand the aircraft communication and navigation systems.
c) Introduce the need & use of Interrupt structure 8085 & 8086 microprocessor.
d) Boosting knowledge about the microprocessor application.
e) Learn the flight control system

UNIT I AIRCRAFT BATTERIES, DIGITAL AIRCRAFT SYSTEMS **9 Periods**

Aircraft Storage Batteries: Dry Cells and Batteries; Lead Acid Storage Batteries & their maintenance procedures, Installation of Aircraft Batteries. Digital Aircraft Systems, Trouble Shooting Digital Circuits.

UNIT II AIRCRAFT NAVIGATION AND COMMUNICATION **9 Periods**

Aircraft Lights, Radio Theory: Radio waves, Amplifiers, Functions of a Transmitter & Receivers. Communication & Navigation Systems: VHF Communication Systems, Automatic Direction Finder Systems. Weather Warning Systems: Radar, Digital Airborne Weather Radar Systems, stall warning.

UNIT III INTRODUCTION TO MICROPROCESSORS **9 Periods**

Block Diagram of Microprocessors – Architecture of Intel 8085, Instruction Classification, Data format and storage, Bus Structure of 8085,Addressing modes, Overview of the 8085 Instruction Set, Development of Simple Assembly Language Program. Internal architecture and functioning of Intel 8086.

UNIT IV MICROPROCESSOR APPLICATION **9 Periods**

RAM, ROM, EPROM, Memory Interfacing, Interfacing Input Devices, Memory Mapped I/O, Basic Concepts in Serial I/O, Interfacing a matrix keyboard, 8255,8259,DMA Data transfer & 8237.

UNIT V FLIGHT CONTROL SYSTEM **9 Periods**

Electronic Flight Systems, Automatic Flight Control Systems, Automatic Flight & Landing Systems, Flight Management System, Ring Laser Gyro.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Evaluate the batteries which are used in aircraft and the various trouble shooting digital circuits.
b) Understood the basic concepts of transmitter and receiver in aircraft systems.
c) Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.
d) Evaluate the various microprocessor applications applied in flight control systems.
e) Apply the knowledge of automatic flight control systems and its microprocessor applications.

TEXT BOOKS

1. Thomas K. Eismin “Aircraft – Electricity & Electronics” Mc Grawhill International Publications -Sixth Edition, 2014.
2. Goankar R.S., “Microprocessors Architecture. Programming and Applications with the 8085”. Pen ram Intl. publishing (India) pvt. Ltd.-Mumbai- 2007.

REFERENCE BOOKS

1. Digital Principles & Applications, A.P. Malvino, D.P.Leach & Saha, 7th Edition 2004.
2. Goankar. R.S., “Microprocessors, Programming to Architecture 8085”, Penram International publishing, Pvt.Ltd, New Delhi. 5th Edition 2002.

3. Krishna Kant. “Microprocessors and Microcontrollers: Architecture, Programming and System Design
8085, 8051, 8096” japee institute of information technology, Noida 2012.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Evaluate the batteries which are used in air-craft and the various trouble shooting digital circuits	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understood the basic concepts of transmitter and receiver in aircraft systems.	**3**	**1**		**3**	**1**	**3**	**1**	**3**						**1**	
Co3	Design system using memory chips and pe-ripheral chips for 16 bit 8086 microprocessor	**3**	**1**		**3**	**3**	**3**	**1**	**3**	**1**					**1**	
Co4	Evaluate the various microprocessor applica-tions applied in flight control systems.	**3**	**1**		**3**	**1**	**3**	**1**	**3**						**1**	
Co5	Apply the knowledge of automatic flight control systems and its micro-processor applications.		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

618AEE11 **Space Flight Navigation and Guidance Control**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Introduce the concepts of Navigation and guidance.
b) Understand the concept of Aerospace vehicles and flight control system.
c) Analyze the performance of control techniques in aerospace system.
d) Learn the concepts of aircraft controls and techniques.
e) Understand a various types of controls in the spacecraft.

UNIT I NAVIGATION **9 Periods**

Introduction, Basic Principles and Definitions; Dead reckoning and Position Fixing, Celestial, Radio, Inertial Navigation; Principle and Construction of Accelerometers, Mechanical Gyros and Ring Laser Gyros, Inertial Measurement Units, Navigation Equations, Sensor Error Models, Kalman Filter, Attitude Heading Reference System, GPS, Terrain Reference Navigation

UNIT II GUIDANCE **9 Periods**

Optimal Terminal Guidance of Interceptors, Optimal Terminal Guidance - planar and non-planar, Robust and Adaptive Guidance, Guidance with State Feedback , Guidance with Normal Acceleration Input , Minimum Energy Orbital Transfer

UNIT III AIRCRAFT CONTROLS **9 Periods**

Powered Flying Controls, Helicopter Flight Controls, Fly-by-Wire Flight Control, Control laws, Redundancy and Failure Survival, Digital Implementation, Fly-by-Light Flight Control, Auto Pilot, Flight Management Systems, Unmanned Aerial Vehicles

UNIT IV CONTROL TECHNIQUES OF ROCKETS AND MISSILES **9 Periods**

Open-loop and Closed Loop Control Systems, Multi-variable Optimization, Optimal Control of Dynamic Systems, Hamiltonian and Minimum Principle and Jacobi-Bellman Equation, Linear Time-Varying System with Quadratic Performance Index, Closed-Loop Attitude Control, Roll Control System, Pitch Guidance and Control System of Rockets, Adaptive Pitch Control System, Yaw Control of Rockets, Guidance and Control of Missiles

UNIT V CONTROL OF SPACECRAFT **9 Periods**

Launch of Satellite Spacecraft, Terminal Control of Spacecraft Attitude, Optimal Single-Axis Rotation of Spacecraft, Multi-axis Rotational Maneuvers of Spacecraft, Spacecraft Control Torques, Rocket Thrusters, Reaction Wheels, Momentum Wheels and Control Moment Gyros, Torques - Magnetic Field -Environmental -Gravity-Gradient.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Gain the basic principles of navigation system.
b) Understanding the control position of Orbital Transfer under guidance system.
c) Analyze the various control system techniques and its performance.
d) Relate the control systems and guidance and control of launch vehicles.
e) Knowledge about injection of satellite Spacecraft control techniques.

TEXT BOOKS

1. Tewari, A. " Advanced Control of Aircraft, Spacecraft and Rockets", John Wiley & Sons, Ltd, Chi Chester, UK, 2011
2. R.P.G Collinson, "Introduction to Avionics Systems", Springer; 3rd ed. edition, 2011.

REFERENCE BOOKS

1. Noton, M. “Spacecraft navigation and Guidance”, Springer-Verlag, Germany, 1998.
2. Richard H. Battin “An Introduction to the Mathematics and Methods of Astrodynamics”, AIAA, 1999.
3. Nagrath. M. and Gopal. I.J. “Control Systems Engineering”, Wiley eastern Ltd...2001.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Gain the basic principles of navigation system.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co2	Understanding the control position of Orbital Transfer under guidance system.	**3**	**1**		**3**	**3**	**3**	**1**	**3**						**1**	
Co3	Analyze the various control system techniques and its performance.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Relate the control systems and guidance and control of launch vehicles.	**3**	**1**		**3**	**1**	**3**	**1**	**2**						**1**	
Co5	Knowledge about injection of satellite Spacecraft control techniques.	**3**	**2**		**3**	**2**	**3**	**1**	**3**						**1**	

618ME007	Applied Hydraulics and Pneumatics	L	T	P	C
		3	0	0	3

PRE-REQUISITES: Knowledge of Engineering Physic I, Basics of Civil and Mechanical Engineering and Fluid Mechanics and Machinery are required.

COURSE OBJECTIVES

The students will be able to

a) Familiar with applications, advantages of the fluid power engineering and transmission systems.

b) Learn the function of fluid power systems in automation for the machine tools and others industrial equipment's like heavy earth movers and construction equipment's.

c) Draw the invention of circuits for hydraulic and pneumatic power systems in the industrial applications.

d) calculating the fluid flow in the components and the system of hydraulics.

e) understand about pneumatic systems.

UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS **9 Periods**

Introduction to Fluid power- Advantages and Applications- Types of fluid power systems – Fluid power symbols-Types of fluids- Properties of hydraulics fluids – Applications of Pascal's Law- Principles of flow – Work, Power and Torque-Darcy–Weisbach equation, Losses in pipe, valves and fittings .

UNIT II HYDRAULIC SYSTEMS AND COMPONENTS **9 Periods**

Sources of Hydraulic power: Pumping theory – Pump classification- Variable displacement pumps for Gear pump, Vane pump and Piston pump Construction, working principle, advantages, disadvantages and Performance-Types of hydraulic cylinders- Linear cylinders, Rotary cylinders, construction, working principle, advantages, disadvantages and applications- Cushioning Mechanism in cylinder.

UNIT III CONTROL COMPONENTS, ACCESSORIES OF HYDRAULIC SYSTEMS **9 Periods**

Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation, Applications – Types of actuation- Accessories: Reservoirs, Accumulators, Intensifiers and Pressure Switches- Applications.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS **9 Periods**

Properties of air-Compressors- (FRL)Filter, Regulator, Lubricator ,Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems and Proportional valves -Introduction the fluidics devices -Pneumatic logic circuits.

UNIT V HYDRAULIC AND PNEUMATIC CIRCUITS AND TROUBLESHOOTING **9 Periods**

Hydraulic circuits: Regenerative (with accumulator devices), Fail-safe, Speed control, Sequence, Electro hydraulic circuits-Case studies of to draw the circuits of hydraulic system for the Shaping and Punching operation (with intensifier device).Pneumatic circuits: Sequential circuit design for simple application (of two or three cylinders) using cascade method-Electro pneumatic circuits- Fluid power circuits failures and troubleshooting.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Gaining the concept of fluid power systems and applications in industries.
b) Understanding the working principle of hydraulic and pneumatic systems.

c) Design the hydraulic and pneumatic circuits and exposure of diagnose or troubleshoot the power systems.
d) An ability to apply the applied hydraulics concepts to machining operations like shaping, punching, etc.
e) Recognize the standard symbols of the different components used in fluid power and pneumatics systems.

TEXT BOOKS

1. Anthony Esposito," Fluid Power with Applications", Pearson Education, 2009.
2. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw Hill, 2002

REFERENCES BOOKS

1. Srinivasan .R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
3. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
Co1	Gaining the concept of fluid power systems and applications in industries.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co2	Understanding the working principle of hydraulic and pneumatic systems.	**3**	**1**		**3**	**2**	**3**	**2**	**2**						**1**	
Co3	Design the hydraulic and pneumatic circuits and exposure of diagnose or troubleshoot the power systems.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co4	.An ability to apply the applied hydraulics concepts to machining operations like shaping, punching, etc.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co5	.Recognize the standard symbols of the different components used in fluid power and pneumatics systems	**3**	**2**		**3**	**2**	**3**	**2**	**2**						**1**	

618AEE13 **Structural Dynamics**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the effect of periodic and a periodic forces on mechanical systems with matrix approach
b) Discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems
c) Understand the natural characteristics of large sized problems using approximate methods
d) Learning about natural methods of vibration and energy methods
e) Evaluating the frequencies and dynamics.

UNIT I FORCE DEFLECTION PROPERTIES OF STRUCTURES **9 Periods**

Constraints and Generalized coordinates – Virtual work and generalized forces – Force – Deflection Influence functions – stiffness and flexibility methods.

UNIT II PRINCIPLES OF DYNAMICS **9 Periods**

Free and forced vibrations of systems with finite degrees of freedom – Damped oscillations-D'' Alembert's principle – Hamilton's principle – Lagrangian equations of motion and applications

UNIT III NATURAL MODES OF VIBRATION **9 Periods**

Equations of motion for free vibrations solution of Eigen value problems – Normal Coordinates and orthogonality relations.

UNIT IV ENERGY METHODS **9 Periods**

Rayleigh's principle – Rayleigh – Ritz method – Coupled natural modes – Effect of rotary inertia and Shear on lateral vibrations of beams – Natural vibrations of plates.

UNIT V APPROXIMATE METHODS **9 Periods**

Approximate methods of evaluating the Eigen frequencies and the dynamics response of continuous systems-Matrix methods of dynamic stress analysis.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Knowing various options of mathematical modeling of structures.
b) Analyze the equations of motion for vibratory systems and solving for the free and forced response.
c) Knowledge in natural modes of vibration of structures.
d) Evaluate the response of structures under various dynamically loaded conditions.
e) Gaining knowledge in numerical and approximate methods of evaluating dynamic response of the systems.

TEXT BOOKS

1. Morse. I.E. and Hinkle. H.T., "Mechanical Vibrations: Theory and Applications", Prentice Hall of India Pvt. Ltd, New Delhi, 2004.
2. Hurty.W.C. and M.F. Rubinstein, "Dynamics of Structures", Prentice Hall of India Pvt. Ltd., New Delhi.1987.

REFERENCE BOOKS

1. Vierck. R.K., "Vibration Analysis", 2nd Edition, Thomas Y. Crowell & Co Harper & Row Publishers, New York, U.S.A. 1989.
2. Timoshenko. S.P., and D.H. Young, "Vibration Problems in Engineering", John Willey & Sons Inc.1984.
3. Ramamurthy. V., "Mechanical Vibration Practice and Noise Control" Narosa Publishing House Pt. Ltd, 2008.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Knowing various options of mathematical modeling of structures.	**3**	**1**		**3**	**3**	**2**	**1**	**3**						**1**	
Co2	Analyze the equations of motion for vibratory systems and solving for the free and forced response.	**3**	**1**		**3**	**3**	**2**	**1**	**2**						**1**	
Co3	Knowledge in natural modes of vibration of structures	**2**	**1**		**3**	**3**	**2**	**1**	**1**						**1**	
Co4	Evaluate the response of structures under various dynamically loaded conditions.	**3**	**1**		**3**	**2**	**2**	**1**	**1**						**1**	
Co5	Gaining knowledge in numerical and approximate methods of evaluating dynamic response of the systems	**2**	**2**		**3**	**3**	**2**	**1**	**2**						**1**	

618AEE14 **Aircraft Maintenance Practice**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Study the concepts of the maintenance and repair for performing the manufacturer's manual.
b) Knowledge about aircraft safety and inspection for general engineering and maintenance practices.
c) Understand the basic concepts of the maintenance and repair of both piston and jet aero engines based on maintenance manual.
d) Learn about self safety and machine maintenance and tools safety
e) Understand inspect the hardware of an aircraft.

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT **9 Periods**

Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS **9 Periods**

Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance.

UNIT III MAINTENANCE OF SAFETY AND TOOLS **9 Periods**

Shop safety – Environmental cleanliness – Precautions –Aircraft fastening devices – Bolts and screws, Nuts and Washers, Locking devices and springs – Bearings and Gears

UNIT IV INSPECTION **9 Periods**

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets– ATA Specifications

UNIT V AIRCRAFT HARDWARE **9 Periods**

Hand tools – Precision instruments – Special tools and equipment in an airplane maintenance shop– Identification terminology – Specification and correct use of various aircraft hardware – Identification of all types of fluid line fittings. Materials, metallic and nonmetallic Plumbing connectors – Cables.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Gain the knowledge in various ground support system for aircraft operations.
b) Understood the operation of Air conditioning and pressurization systems in ground level conditions.
c) Identify the aircraft component safety and reliability of aircraft systems service and its environmental condition.
d) Ability to carry out the ground servicing of critical aircraft systems during the aircraft maintenance manual.
e) Knowledge in specifications standards of aircraft hardware systems.

TEXT BOOKS

1. Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993.
2. Larry Reithmaier, "Standard Aircraft Handbook (5th Edition) "1991.

REFERENCE BOOKS

1. Larry Reithmier, "Aircraft Repair Manual", Palemae Books Marquette, 1992.
2. A&P Mechanics, "Aircraft Hand Book", FAA Himalayan Book House, New Delhi, 1996.
3. A&P Mechanics," General Hand Book", FAA Himalayan Bok House, New Delhi, 1996.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Gain the knowledge in various ground support system for aircraft operations	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Understood the operation of Air conditioning and pressurization systems in ground level conditions.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co3	Identify the aircraft component safety and reliability of aircraft systems service and its environmental condition.	**3**	**1**		**3**	**2**	**3**		**1**				**1**		**1**	
Co4	Ability to carry out the ground servicing of critical aircraft systems during the aircraft maintenance manual.	**3**	**1**		**3**	**2**	**3**	**1**			**1**				**1**	
Co5	Knowledge in specifications standards of aircraft hardware systems.		**2**		**3**	**2**	**3**	**1**	**2**						**1**	

618AEP09	Aero Engine Repair and Maintenance Laboratory aircraft Design Lab	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

The students will be able to

a) Understand the basic concept of piston engine components.
b) Know the Importance of Combustor, Propellers and Nozzles in Aircraft Engines.
c) Gain the knowledge about Engine performance and quality testing.
d) The failure modes and the use of destructive and nondestructive testing techniques of engineering materials
e) Learning engine starting procedures and taxing aircraft.

LIST OF EXPERIMENTS

1. Disintegration of an aircraft piston engine
2. Engine (Piston Engine) - cleaning, visual inspection.
3. Study of Piston Engine Components - dimensional checks.
4. Engine Piston reassembly.
5. Disintegration and study of fuel system of a jet engine
6. Identification of components & trouble shooting of Jet Engine
7. NDT checks and dimensional checks of Jet Engine
8. Engine starting procedures.
9. Ground running of aircraft.
10. NDT checks and dimensional checks of piston engine components.

TOTAL: 45 Periods

COURSE OUTCOMES

After successful completion of this course, the students should be able to

a) Identify the defects in an aircraft's piston engine and jet engine.
b) Start the piston and jet engines of an aircraft with the help of user manuals.
c) Evaluate the performance of various non-destructive tests.
d) Develop the knowledge of Performance of air breathing engines.
e) Develop the knowledge of disintegration of piston engine.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No	Details of Equipment's	Qty Req.	Experiment No.
1.	Piston Engines	2	1,2,3,4
2.	Jet Aero Engines	2	5,6,7,8
3.	Aircraft with serviceable stand	1	1 to 9
4.	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI	2 each	3,1,7
5.	NDT Equipment's (Defect scope, Dye penetrant method, Hot oil Chalk Method	1 each	7,10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Identify the defects in an aircraft's piston engine and jet engine	**3**	**1**		**3**	**2**	**3**	**1**	**1**						**1**	
Co2	Start the piston and jet engines of an aircraft with the help of user manuals.	**3**	**1**		**2**	**2**		**1**	**1**						**1**	
Co3	Evaluate the performance of various non-destructive tests.	**2**	**1**			**2**	**3**	**1**	**1**						**1**	
Co4	Develop the knowledge of Performance of air breathing engines.	**3**	**1**		**3**	**2**	**3**	**1**	**1**						**1**	
Co5	Develop the knowledge of disintegration of piston engine.	**2**	**2**		**2**	**2**	**3**	**1**	**1**						**1**	

618AEP07 **Aircraft Interior Design Laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

a) To design various individual components, sub-assemblies and main assemblies.
b) Discuss the importance of design process and studying the different phases of designing process involved in the design.
c) Understand the design of aircraft concepts.
d) To design various aircraft components by using Catia V5 software.
e) Design about the glass of window and wind shield.

LIST OF EXPERIMENTS

1. Aircraft Seating Design Arrangements (General Class) (2D)
2. Aircraft Seating Design Arrangements (Business Class) (2D)
3. Aircraft Single Aisle Design (2D)
4. Aircraft Twin Aisle Design (2D)
5. Aircraft Seat Design (3D- Business Class)
6. Aircraft Seat Design (3D- First Class)
7. Design of Laptop Tray Sizing for Seating in Civil Aircrafts.
8. Design of Window for Civil Aircraft
9. Design of Wind Shield for Fighter Aircraft (Select any one airplane)
10. Design of Wind shield for Passenger Aircraft (Select any one Airplane)

TOTAL: 45 Periods

COURSE OUTCOMES

a) Understand the importance of drawing and design process and phases involved in the design process.
b) Ability to design various individual components, sub-assemblies and main assemblies in drawing lab.
c) Ability to Design various orthographic and isometric projections in drawing sheets.
d) Ability to develop and understand Basic Concepts of aircraft.
e) Skill to developing and design the wind shield and windows glass of aircraft

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No.	Name of equipment's	Qty Req.	Experiment No
1.	Computers	36	1 to 10
2.	Pro-E -Wildfire, AutoCAD(latest), CATIA,SOLIDWORKS	36 licenses	1 to 10
3.	UPS 10 KV a 3 Phase	1	1 to 10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understand the importance of drawing and design process and phases involved in the design process	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Ability to design various individual components, sub-assemblies and main assemblies in drawing lab.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Ability to Design various orthographic and isometric projections in drawing sheets.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Ability to develop and understand Basic Concepts of aircraft.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Skill to developing and design the wind shield and windows glass of aircraft		**2**		**3**	**2**	**3**	**1**	**3**						**1**	

618AEP11 **CAD/CAM Laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

a) To teach and train the students in the laboratory about the design and drafting of aero components.
b) To gain practical experience in handling 2D drafting and 3D modelling software systems.
c) To make the students to understand and interpret drawings of machine components so as to prepare assembly drawings both manually and using standard CAD packages.
d) To familiarize the students with Indian standards on drawing practices and standard components.
e) To make drawings of CFD model and fundamentals.

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling of wing
4. Advanced modeling of aero component
5. Study of CFD/FEM Fundamentals
6. Flow Simulation over a Symmetrical Airfoil Using CFD
7. Flow Simulation over a Cambered Airfoil Using CFD
8. Flow Simulation over A Turbine Blade (static analysis) Using CFD
9. Stress Analysis of a Turbine Blade (Rotation only and no pressure loads)
10. Stress Analysis of Any Aircraft Component

TOTAL: 45 Periods

COURSE OUTCOMES

a) Ability to develop 2D and 3D part models using modeling software.
b) Ability to prepare engineering drawing for industrial component using Indian standard code of practice.
c) Ability to prepare bill of materials for production drawings.
d) Ability to prepare the assembly models and apply the sectioning methods.
e) Ability to prepare the parts of the structures of the aircraft.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No.	Name of equipment's	Quantity	Experiment No
1.	Computers	36	1 to 10
2.	Pro-E -Wildfire, AutoCAD(latest), CATIA,SOLIDWORKS	36 licenses	1 to 10
3.	ANSYS- 11 with Fluent, NASTRAN,CFX	36 licenses	1 to 10
4.	UPS 10 KV a 3 Phase	1	1 to 10

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Ability to develop 2D and 3D part models using modeling software.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Ability to prepare engineering drawing for industrial component using Indian standard code of practice.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Ability to prepare bill of materials for production drawings.	**3**	**1**		**3**		**2**	**1**	**3**			**1**			**1**	
Co4	Ability to prepare the assembly models and apply the sectioning methods.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Ability to prepare the parts of the structures of the aircraft.	**2**	**2**		**3**	**2**	**2**	**1**	**3**				**1**		**1**	

618AEP12 **MAT lab**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE

The Students will be able to

a) Understand the basic principles of programming and of implementing mathematical concepts in MATLAB
b) Find the Variables and constants by Simple Calculations of MAT LAB
c) Conduct Experiment on Matrix Operations and Functions in MATLAB
d) Write numerical algorithms and evaluate the computational results using graphical representations
e) Teaching the matrix operations and programing about MATLAB

LIST OF EXPERIMENTS

1. MATLAB basics - The MATLAB environment - Basic computer programming
2. MATLAB toolboxes - Variables and constants, operators and simple calculations - Formulas and functions
3. Matrices and vectors - Matrix and linear algebra review - Vectors and matrices in MATLAB
4. Matrix operations and functions in MATLAB
5. Computer programming - Algorithms and structures
6. MATLAB scripts and functions (m-files) - Simple sequential algorithms - Control structures (if…then, loops)
7. MATLAB programming - Reading and writing data, file handling - Personalized functions - Toolbox structure - MATLAB graphic functions
8. Numerical simulations - Numerical methods and simulations - Random number generation – Monte Carlo methods

TOTAL: 45 Periods

COURSE OUTCOME

Upon completion of the course, students will be able to

a) Learn basic principles of programming and of implementing mathematical concepts in MATLAB.
b) Compute the Variables and constants by Simple Calculations of MAT LAB.
c) Do the Experiment on Matrix Operations and Functions in MATLAB.
d) Analyze numerical algorithms and evaluate the computational results using graphical representations.
e) Ability of reading and writing the data.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl.No	Details of Equipment's	Qty Req.	Experiment No.
1.	MAT LAB & Simulink Software	10 License	1 to 8
2.	Computers of configuration 4 gb ram, Dual Core Processor, 320 HD.	36	1 to 8

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Learn basic principles of programming and of implementing mathematical concepts in MATLAB.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co2	Compute the Variables and constants by Simple Calculations of MAT LAB	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co3	Do the Experiment on Matrix Operations and Functions in MATLAB.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co4	Analyze numerical algorithms and evaluate the computational results using graphical representations.	**3**	**1**		**3**	**2**	**2**	**1**	**2**						**1**	
Co5	Ability of reading and writing the data.	**3**			**3**	**2**	**3**	**1**	**3**						**1**	

618AEP13 **Heat Transfer Laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

The Students will be able to

a) Understand heat transfer fundamentals, and apply them to engineering problems.
b) Understanding practical heat transfer measurements in laboratories, and compare measurements with theories
c) Use Excel for data analyses and engineering plots, and use word for technical report writing
d) Consider experimental design issues for heat transfer laboratories

LIST OF EXPERIMENTS

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat Transfer through a Concentric Sphere
3. Thermal Conductivity of given metal rod.
4. Heat transfer through pin-fin
5. Experiment on Transient Heat Conduction
6. Heat transfer in forced convection.
7. Heat transfer in natural convection.
8. Parallel and counter flow heat exchanger.
9. Study of Emissivity apparatus.
10. Study of heat pipe and its demonstration.

TOTAL: 45 Periods

COURSE OUTCOMES

Upon completion of the course, students will be able to

a) Understand the basic laws of heat transfer, account for the consequence of heat transfer in thermal analyses of engineering systems.
b) Analyze problems involving steady state heat conduction in simple geometries, develop solutions for transient heat conduction in simple geometries.
c) Obtain numerical solutions for conduction and radiation heat transfer problems, understand the fundamentals of convective heat transfer process.
d) Evaluate heat transfer coefficients for natural convection, inside ducts.
e) Obtaining the skillset of emissivity apparatus and heat pipe and dimensions.

LIST OF EQUIPMENTS

(For a batch of 36 students)

Sl. No	Details of Equipment's	Qty Req.	Experiment No.
1.	Composite Slab Apparatus (Slabs ,Heater coil, Dimmer stat ,Volt meter ,Ammeter range, Digital temperature indicator, Thermocouple)	2	1,2,4,5,6,7
2.	Thermal Conductivity Apparatus	1	3
3.	Heat Exchanger Apparatus	1	8

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Understand the basic laws of heat transfer, account for the consequence of heat transfer in thermal analyses of engineering systems.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co2	Analyze problems involving steady state heat conduction in simple geometries, develop solutions for transient heat conduction in simple geometries.	**3**	**1**		**3**	**2**	**3**	**1**	**2**						**1**	
Co3	Obtain numerical solutions for conduction and radiation heat transfer problems, understand the fundamentals of convective heat transfer process.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co4	Evaluate heat transfer coefficients for natural convection, inside ducts.	**3**	**1**		**3**	**2**	**3**	**1**	**3**						**1**	
Co5	Obtaining the skillset of emissivity apparatus and heat pipe and dimensions.	**3**	**2**		**3**	**2**	**3**	**2**	**1**		**1**				**1**	

718AET01	Fracture Mechanics and Mechanisms	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

The students will be able to

a) Obtain the knowledge about mechanical behavior of a material under various loading conditions.
b) Understand concept of stress concentration and able to plot S-N curves for various component fractures.
c) Identify and formulate the stress intensity factor for typical crack configurations.
d) Predict the critical loads that will cause catastrophic failure in a structure.
e) Understand the behavior of material failures and their quality.

UNIT I FRACTURE MECHANICS PRINCIPLES **9 Periods**

Introduction, Mechanisms of Fracture, Tensile Testing, and Crack in structure, Brittle Fracture, Ductile Fracture. Griffith's criterion, modern design – strengths, stiffness and toughness. Stress intensity approach.

UNIT II STRESS ANALYSIS FOR MEMBERS WITH CRACKS **9 Periods**

Linear elastic fracture mechanics, Crack tip stress and deformations, Relation between stress intensity factor and fracture toughness, Stress intensity based solutions. Crack tip plastic zone estimation, Plane stress and plane strain concepts. The Dugdale approach, the thickness effect.

UNIT III ELASTIC – PLASTIC FRACTURE MECHANICS **9 Periods**

Elastic–plastic factor criteria, crack resistance curve, J-integral, Crack opening displacement, crack tip opening displacement. Importance of R-curve in fracture mechanics, experimental determination of J-integral, COD and CTOD.

UNIT IV FATIGUE AND FATIGUE CRACK GROWTH RATE **9 Periods**

Introduction to fatigue, factors Affecting Fatigue, Fatigue loading, various stages of crack propagation, the load spectrum, approximation of the stress spectrum, the crack growth integration, fatigue crack growth laws.

UNIT V FRACTURE TOUGHNESS AND FATIGUE TESTING OF METALS **9 Periods**

Specimen size requirements, various test procedures, effects of temperature, loading rate and plate thickness on fracture toughness. Fracture testing in shear modes, fatigue testing, and NDT methods.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Learn and understand the mechanical behavior of a material under various loading conditions
b) Acquire knowledge about the concept of stress concentration and able to plot S-N curves for various component fractures.
c) Have Exposure on nonlinear fracture-mechanics parameters, such as J and T integral.
d) Get Knowledge about the rate of stress concentration statistical aspects of fatigue behaviour and Finite Element analysis.
e) Analyze the effect of fatigue and fracture mechanics to engineering issues.

TEXT BOOKS

1. Jayatilake. “Fracture of Engineering Brittle Materials”, Applied Science, London. 2015.
2. Karen Hellan “Introduction to Fracture Mechanics”, McGraw Hill Pub.2012.
3. R.W. Hertzberg, Callister, Deformation and Fracture Mechanics of Engineering Materials, Fourth Edition, John Wiley and Sons, Inc., 2014

REFERENCE BOOKS

1. T.L. Anderson, “Fracture Mechanics – Fundamentals and Application”, CRC press 2012.
2. David Broe “Elementary Engineering Fracture Mechanics”, Artinus Nijhoff, London 2007.
3. Rolfe and Barsom “Fracture and Fatigue Control in Structures”, Printice Hall 2000.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Learn and understand the mechanical behavior of a material under various loading conditions	3	2		3	2	3	1					1		1	
C02	Acquire Knowledge about the concept of stress concentration and able to plot S-N curves for various component fractures	3	3		3	2	3	1		2					1	
C03	Have Exposure on nonlinear fracture - mechanics parameters such as J and T integral	3	3		3	2	3	1			1				1	
C04	Get Knowledge about the rate of stress concentration statistical aspect of fatigue behavior and finite elememt analysis	3	3		3	2	3	1							1	
C05	Analyze the effect of fatigue and fracture mechanics to engineering issues		2		3	2	3	1							1	

718AET02	Avionics	L	T	P	C
		3	0	0	3

Pre-requisite: Aircraft Systems and Instruments

COURSE OBJECTIVE

The students will be able to

a) Understand the needs of avionics for both Civil and Military Aircraft.
b) Know the knowledge about digital electronic principles and working operations of digital circuit
c) Integrate the digital electronics with cockpit equipment.
d) Understand the various principles in flight desk and cockpit panels.
e) Study the communication and navigation systems.

UNIT I INTRODUCTION TO AVIONICS **9 Periods**

Need for Avionics in civil and military aircraft and space systems – Integrated Avionics and Weapon system – Typical avionics sub systems – Design and Technologies.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS **9 Periods**

Digital Computers – Microprocessors – Memories- Multiplexers and De-multiplexers-Latches and Flip FlopsCounters-Shift Registers: Memories- A/D and D/A converters

UNIT III DIGITAL AVIONICS ARCHITECTURE **9 Periods**

Avionics system architecture–Data buses MIL–STD 1553 B–ARINC 429–ARINC 629. Avionics Full-Duplex Switched Ethernet.

UNIT IV FLIGHT DECK AND COCKPITS **9 Periods**

Control and display technologies, CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and Military cockpit: MFDS, HUD, MFK, HOTAS

UNIT V COMMUNICATION AND NAVIGATION SYSTEMS **9 Periods**

Communication Systems: Radio Frequency Spectrum, HF, VHF, UHF, SATCOM, ATC Transponder and Interrogator, TCAS, GPWS, and ADS-B.

Navigation Systems: Classification, VOR/DME, LORAN, RNAV, Doppler and Inertial Navigation, Satellite Navigation, Hybrid Navigation – Approach and Landing aids: ILS, GLS and MLS.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Understood the needs of Avionics in Civil, Military Aircraft and Space systems.
b) Apply basic inputs to aircraft digital instruments for efficient output.
c) Knowledge about the various Avionics systems architecture and apply to sub systems in Aircraft.
d) Demonstrate the principles for different displays used in aircraft systems.
e) Awareness of communication and navigation systems and their applications in aircraft.

TEXT BOOKS

1. Malcrno A.P. and Leach, D.P., “Digital Principles and Application”, Tata McGraw-Hill, 8th edition, 2014.
2. R.P.G.Collinson ‘introduction to avionics systems’, springer 2nd edition 2006.

REFERENCE BOOKS

1. MikeTooley David Wyatt "Aircraft Navigation and Communication Systems" 1st edition, Elsevier, England, 2007.
2. Brain Kendal, "Manual of Avionics", The English Book House, 3rd Edition, New Delhi, 2011.
3. Gaonkar, R.S., "Microprocessors Architecture – Programming and Application", Wiley and Sons Ltd-New Delhi, 5th edition, 2011.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Understood the needs of Avionics in Civil Military Aircraft and space systems	3	2		2	2	3	1					2		2	
C02	Apply basic inputs to aircraft digital instruments for efficient output	3	1		2	2	3	1		2					1	
C03	Knowledge about the various Avionics system architecture and apply to sub sustem in aircraft	3	2		2	2	2	1			2				1	
C04	Demonstrate the principles for different displays used in aircraft systems	3	3		1	2	3	1							2	
C05	Awareness of communication and navigation system used in aircraft system		2		3	2	1	1							1	

718AET03	Airline and Airport Management	L	T	P	C
		3	0	0	3

Pre-requisite: Air Traffic Control and Aerodrome Design

COURSE OBJECTIVE

The students will be able to

a) Gain the knowledge about Airline, Airport management principles and their functions.
b) Acquire knowledge about economic parameters in an aviation industry.
c) Understand the basic steps involved in airline, airport scheduling and maintenance.
d) Ensure methods to follow the aircraft maintenance reliability.
e) Apply the product quality technologies to use in aircraft maintenance.

UNIT I AIRLINE AND AIRPORT ADMINISTRATION **9 Periods**

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT II AIRLINE ECONOMICS **9 Periods**

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

Fleet Planning: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT III PRINCIPLES OF AIRLINES SCHEDULING **9 Periods**

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipment's and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV AIRCRAFT RELIABILITY **9 Periods**

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT V TECHNOLOGY IN AIRCRAFT MAINTENANCE **9 Periods**

Airlines scheduling (with reference to engineering) – Product support and spares – Maintenance sharing – Equipment's and tools for aircraft maintenance – Aircraft weight control – Budgetary control. On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Analyze the design requirements related to Airport Management operations.
b) Estimate the runway requirements for performance of aircraft during takeoff and landing.
c) Understood the functions and operation of the aircraft control, ground electronics airfield lighting, runway and taxi way markings.
d) Appreciate the importance of weather, safety and collision avoidance to ensure Aviation safety and Security.
e) Familiarize with next generation Radar, communication, ATC network and compliance to environmental acts.

TEXT BOOKS

1. Fedric J.H., "Airport Management", Wadsworth Publishing Company, California, 1993.
2. C.H. Friend, "Aircraft Maintenance Management" Longman- 2000.

REFERENCE BOOKS

1. Gene Kropf "Airline Traffic Procedures "McGraw-Hill; First Edition January 1, 1949.
2. George Lloyd Wilson, Leslie Aulls Bryan "Air Transportation" Prentice-Hall, Aeronautics-1949.
3. Alexander T Wells, "Air Transportation", Wadsworth Publishing Company, California, 1993.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Analyze the design requirements related to airport Management operations	3	3		2	1	2	2					2		1	
C02	Estimate the runway requirements for performance of aircraft during takeoff and landing	3	1		2	1	3	2		2					1	
C03	Understood the functions and operation of the aircraft control ground electronics airfield lighting, runway and taxi way marking	3	2		2	2	2	2			2				1	
C04	Appreciate the importance of weather, safety and collision avoidance to ensure Aviation safety and security	3	2		1	3	3	2							1	
C05	Familiarize with next generation Radar, communication, ATC network and compliance to environment acts		1		3	2	3	2							1	

718AET04	Vibrations and Aero elasticity	L	T	P	C
		3	0	0	3

Pre-requisite: Engineering Mechanics

COURSE OBJECTIVE

The students will be able to

a) Understand the simple harmonic motion and terminologies involved in D' Alembert's principle of motion.
b) Divide vibrations based on the parameters and their significant measuring instruments.
c) Know the multi degree freedom of a system and its importance.
d) Know the natural frequency of a given object by numerical examples.
e) Understand the application of Aero elasticity and its effects on aircraft components.

UNIT I BASIC NOTIONS **9 Periods**

Simple harmonic motion – Terminologies – Newton's Law – D' Alembert's principle –Energy Methods

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS **9 Periods**

Free vibrations – Damped vibrations – Forced Vibrations, with and without damping –support excitation – Vibration measuring instruments.

UNITI II MULTI DEGREES OF FREEDOM SYSTEMS **9 Periods**

Two degrees of freedom systems – Static and Dynamic couplings vibration absorber- Principal co-ordinates, Principal modes and orthogonal condition – Eigen value problems. Hamilton's principle- Lagrangian equation and application – Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations.

UNIT IV APPROXIMATE METHODS **9 Periods**

Rayleigh's and Holzer Methods to find natural frequencies.

UNIT V ELEMENTS OF AEROELASTICITY **9 Periods**

Concepts – Coupling – Aero elastic instabilities and their prevention – Basic ideas on wing divergence, loss and reversal of aileron control – Flutter and its prevention.

TOTAL: 45 Periods

COURSE OUTCOME

On successful completion of this course, student should be able to

a) Understand the basics of vibrations and simple harmonic motion.
b) Differentiate between types of vibrations according to dampness and particle motion.
c) Learn and Understand the need of a multi degrees of freedom particle and its characteristics.
d) Measure the natural frequency of an object by using Rayleigh and Holzer method.
e) Explain the formation of Aileron reversal, flutter and wing divergence.

TEXT BOOKS

1. S.S.Rao, "Mechanical Vibrations", Pearson Education Inc., 4th Edition, 2011.
2. V.P.Singh "Mechanical Vibrations", Dhanpat Rai& Company Pvt Ltd, 3rdEdition, 2011.

REFERENCE BOOKS

1. Scanlon R.H. & Rosenbaum R, “introduction to the study of aircraft vibration & flutter”, john Wiley and sons. New York, 2014.
2. Y. C. Fung “An Introduction to the Theory of Aero elasticity”– New York, Don Mills 2008.
3. Morse, Hinkle, R.T., “Mechanical vibrations”, – Prentice hall, New York, 2012.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Understand the basics of vibration and simple harmonic motion	3	2		3	3	2	2					2		1	
C02	Differentiate between types of vibration according to dampness and particle motion	3	2		3	3	3	2		1					1	
C03	Learn and Understand the need of a multi degrees of freedom particle and its characteristics	3	2		2	2	2	2			1				1	
C04	Measure the natural frequency of an object by using Rayleigh and holzer method	3	2		1	2	3	2							1	
C05	Explain the formation of Aileron reversal flutter and wing divergence	3	2		3	2	3	2							1	

718AEP07	Avionics Laboratory	L	T	P	C
		0	0	2	1

Pre-requisite: Digital Electronics and Microprocessor

COURSE OBJECTIVE

Design and implementation of data buses in avionics with MIL – Std. 1553B and remote terminal configuration and their importance in different applications in the field of Avionics.

LIST OF EXPERIMENTS DIGITAL

ELECTRONICS:

1. Addition/Subtraction of binary numbers.
2. Multiplexer/ De- Multiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS:

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.
8. Greatest in a given series & Multi-byte addition in BCD mode. 9. Interface programming with 4 digit 7 segment Display & Switches & LED's. 10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES:

11. Study of Different Avionics Data Buses.
12. MIL-STD – 1553 Data Buses Configuration with Message transfer.
13. MIL-STD – 1553 Remote Terminal Configuration.

TOTAL: 45 Periods

LIST OF EQUIPMENT *(for a batch of 30 students)*

Sl.No	Items	Quantity	Experiment No.
1.	Adder/Subtractor Binary bits Kit	6	1
2.	Timer Kit	6	1
3.	Encoder Kit	6	3
4.	Decoder Kit	6	3
5.	Comparator Kit	6	4
6.	Multiplexer Kit	6	2
7.	De- Multiplexer Kit	6	2
8.	Shift Registers Kit	6	4
9.	Electronic Design Experimenter	6	6,7,9,10
10.	Microprocessor 8085 Kit	9	5,6,7,8,9,10
11.	4 Digit 7 Segment Display	3	6
12.	Switches & LED's Circuit	3	6
13.	16 Channel AD Converter	6	10,9
14.	Digital to Analog Converter	6	10
15.	Cathode Ray Oscilloscope	3	9,10
16.	Regulated Power Supply (5V DC)	9	1,2,3,4
17.	MIL-Std 1553B Setup with Remote Terminal	1	12,13

18.	Computers	2	11,12,13

COURSE OUTCOMES

After successful completion of this course, the students should be able to

a) Design and analyze complex digital circuits.
b) Develop and execute assembly language programs using 8085 for any applications.
c) Interface and control stepper motors using 8085 microprocessor.
d) Integrate avionic systems using MIL-STD-1553B data bus.
e) Integrate avionic systems using ARINC 429 data bus.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Design and analyze complex digital circuits	3	2		2	2	2	1					2		1	
C02	Develop and execute assembly languge programs using 8085 for any applications	3	2		2	2	3	2		1					1	
C03	Interface and control stepper motors using 8085 micro processor	3	2		2	1	1	1			1				1	
C04	Integrate avionic system using MIL-STD-1553B data bus	3	1		1	2	2	2							1	
C05	Integrate avionic system using ARINC429 data bus	3	1		2	1	2	2							1	

718AEP07	Aircraft Systems Laboratory	L	T	P	C
		0	0	2	1

Pre-requisite: Aircraft Systems and Instruments

COURSE OBJECTIVE

To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.

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: 45 Periods

LIST OF EQUIPMENTS *(for a batch of 36 students)*

S.No	Items	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1 to 10
2.	Hydraulic Jacks (Screw Jack)	4	4,5,10
3.	Trestle adjustable	1	1,2,4,8
4.	Spirit Level	2	1,2,4,8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	2	8
9.	Brake load test rig	1	9

COURSE OUTCOMES

After successful completion of this course, the students should be able to

a) Perform aircraft jacking in order to perform maintenance and inspection.
b) Remove and reinstall aircraft wings and undercarriage using manufacturer's manual.
c) Disassemble and assemble sub components of aircraft engines to perform maintenance and inspection.
d) Describe engine ground running procedure.
e) Troubleshoot various systems of aircraft.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Perform aircraft jacking in order to perform maintenance and inspection	1	3		1	3	1	2					1		2	
C02	Remove and reinstall aircraft wings and undercarriage using manufacturer's manual	2	2		2	3	1	2		2					1	
C03	Disassemble and assemble sub components of aircraft engines to perform maintenance and inspection	2	2		2	2	1	3			2				1	
C04	Describe engine ground running procedure	3	3		1	2	2	3							2	
C05	Troubleshoot various system of aircraft	2	2		3	2	2	1							1	

718AEP08	Design and Fabrication of Aeromodelling	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

The students will be able to

a) Define the problem for the project work.
b) Create aircraft system component models using CATIA, AutoCAD, etc.
c) Conduct experiments by considering the constraints such as economics, environment, health and safety.

LIST OF EXPERIMENTS

1. Analyzing the defined problem.
2. Determining the existing solutions.
3. Proposing new solutions.
4. Evaluating all solutions and deciding on a reasonable solution.
5. Implementing the solution.
6. Writing an elaborate report, discussing the results achieved.
7. Making suggestions if any for further work.

TOTAL: 45 Periods

GUIDELINES

1. Selection of a topic or project title in consultation with project guide.
2. Develop a project planning strategy.
3. If it is an industry-sponsored project, a concurrent letter from industry is required.
4. A maximum of 4 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or in the selected industry.
6. At the end of the project, a report will be written and a technical presentation along with demonstration will be made by the students.
7. The report, project demonstration and technical presentation will be evaluated at the end of the semester.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

a) Apply the knowledge of Mathematics, Science, and fundamentals of Aerodynamics, Structures, and Propulsion to identify and formulate the engineering problems in aerospace applications.
b) Analyze and estimate the cost and time
c) Simulate, analyze and interpret data using software tools such as MATLAB, ANSYS fluent, CFX, CFD++, ICEM CFD, GAMBIT, etc.
d) Develop a project planning strategy and work as an individual or as a member on project teams and communicate the results effectively by compiling project reports and presentations.
e) Develop an end product and prepare a technical report/paper.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Apply the knowledge of Mathematics, Science, and fundamentals of Aerodynamics, structure, and Propulsion	3	3		2	2	2	3					2		2	
C02	Analyze and estimate the cost and time	3	3		1	2	2	3		1					2	
C03	Simulate, analyze and interpret data using software tools such as MATLAB, ANSYS fluent, CFX, CFD++, ICEM CFD, GAMBIT, etc.	3	3		1	1	2	3			1				1	
C04	Develop a project planning strategy and work as an individual or as a member on project teams and communicate the results effectively by compiling project reports and presentations	3	3		2		2	3							2	
C05	Develop an end product and prepare a technical report/paper.	3	2		2	3	2	3							1	

718AEE05	Helicopter Maintenance	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Fundamentals of Helicopter and ground handling of bearings
b) Importance of power plants and tail rotors servicing and system rigging is executed
c) Understand the concept of inspection and maintenance of power plant
d) Acquaint with airframes and related systems
e) Understand the concept of maintenance of tail rotor

UNIT I HELICOPTER FUNDAMENTALS **9 Periods**

Basic directions - Ground handling, bearing - Gears- Gradient unit control boosts - Maintenance & Inspection control rigging

UNIT II MAIN ROTOR SYSTEM **9 Periods**

Head maintenance - blade alignment - Static main rotor balance - Vibration - Tracking - Span wise dynamic balance - Blade sweeping -Electronic balancing - Dampener maintenance - Counter weight adjustment - Auto rotation adjustments -,dampeners-Swash plate flight control systems collective - Cyclic - Push pull tubes - Torque tubes - Bell cranks -Mixer box.

UNIT III MAIN ROTOR TRANSMISSIONS **9 Periods**

Engine transmission coupling - Drive shaft - Maintenance clutch - Freewheeling units - Spray clutch - Roller unit - Torque meter - Rotor brake - Maintenance of these components - vibrations - Mounting systems - Transmissions.

UNIT IV POWER PLANTS & TAIL ROTORS **9 Periods**

Fixed wing power plant modifications - Installation - Different type of power plant maintenance. Tail rotor system - Servicing tail rotor track - System rigging.

UNIT V AIRFRAMES AND RELATED SYSTEMS **9 Periods**

Fuselage maintenance - Airframe Systems - Special purpose equipment - Air Conditioning and Cabin Pressurization- Cabin Systems.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Helicopter basics are clearly understood and various maintenance procedures are followed
b) Get a clear idea about Head maintenance with flight and mast control systems.
c) Understand the transmission process in helicopter rotor and torque meter working.
d) Power plant rotors and tail rotor working is studied Concept of rigging is clearly understood.
e) Get an idea about fuselage maintenance procedures with special hardware requirements.

TEXT BOOKS

1. Jeppesen, "Helicopter Maintenance", Jeppesons and Sons Inc., 2000.
2. “The Outlook for Aircraft Maintenance, Repair, and Overhaul (MRO) Services in the United States” by Icon Group International 2016-2021.

REFERENCES BOOKS

1. "Civil Aircraft Inspection Procedures", Part I and II, CAA, English Book House, New Delhi, 1916.
2. Larry Reithmier, "Aircraft Repair Manual", Palamar Books Marquette, 1992.
3. “Aircraft: Maintenance and Repair” by William Watkins and Michael Kroes Publisher: McGraw-Hill Education; 6 edition (March 3, 1993) ISBN-10: 0028034619; ISBN-13: 978-0028034614.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Helicopter basics are clearly understood and various maintenance procedure are followed	1	2		2	2	2	1					2		1	
C02	Get a clear idea about Head maintenance with flight and mast control systems	2	2		2	1	3	2		2					1	
C03	Understand the transmission process in helicopter rotor and torque meter working	2	2		2	1	3	2			2				2	
C04	Power plant rotors and tail rotor working is studied concept of rigging is clearly understood	2	2		2	2	2	2							1	
C05	Get an idea about fuselage maintenance procedures with special hardware requirements	1	2		2	3	3	2							2	

718AEE06	Helicopter Aerodynamics	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Acquaint with the basics of rotating wing concept.
b) Understand the concept of hovering flight dynamics.
c) Understand the concept of forward flight dynamics.
d) Analyze the climb and descent performance.
e) Acquaint with ground effect machines.

UNIT I INTRODUCTION TO ROTATING WING CONCEPT **9 Periods**

Evolution of helicopter-Helicopter configurations - Configurations based on Torque reaction – Jet rotors and compound helicopters –Methods of Control, rotor blade pitch control, –Collective pitch and Cyclic pitch – Lead – Lag and flapping hinges.

UNIT II HOVERING FLIGHT DYNAMICS **9 Periods**

Actuator disc theory-Blade Element Theory-ideal twist Induced & profile power-Figure of merit-Thrust and power coefficients-calculation of drag, torque, power-Ground effect in hover- Estimation of hover ceiling.

UNIT III FORWARD FLIGHT DYNAMICS **9 Periods**

Forward flight performance-Parasite drag and Power-Stall limitations-flapping-cyclic Pitch - Autorotation in hover and in forward flight-Dead man's curve.

UNIT IV CLIMB AND DESCENT PERFORMANCE **9 Periods**

Vertical flight-flow patterns surrounding the rotor-Power required in climb and descent- Descent speed calculations Take-off techniques.

UNIT V GROUND EFFECT MACHINES **9 Periods**

Types – Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machines – Drag of hovercraft on land and water –Applications of hovercraft.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Familiarize on major helicopter components, characteristics and configurations.
b) Apply Momentum and simple blade element theories to helicopter's rotor blades.
c) Analyze the power requirements in forward flight and associated stability problems of helicopter.
d) Apply the ground effect concept to ground effect machines.
e) Analyze the performance of VTOL and STOL aircrafts.

TEXT BOOKS

1. Gupta. L "Helicopter Engineering", Himalayan Books, 1996. 2. Seddon. J "Basic Helicopter Aerodynamics" AIAA education series, 1990.

REFERENCES BOOKS

1. Gessow A & Myers G.C "Aerodynamics of Helicopter" Mac Millan& Co, 1987.
2. Saunders "Dynamics of Helicopter flight", John Wiley, 1975.
3. Newman. S "Foundation of Helicopter Flight" Halsted Press, 1994.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Familiarize on major helicopter components, characteristics and configurations	3	3		3	2	2	1					2		1	
C02	Apply Momentum and simple blade element theories to helicopter's rotor blades	3	3		2	3	1	3		3					3	
C03	Analyze the power requirements in forward flight and associate stability problems of helicopter	3	3		3	3	3	2			3				2	
C04	Analyze the ground effect concept to ground effect machines	3	3		2	2	2	1							1	
C05	Analyze the performance of VTOL and STOL aircrfats	3	3		3	3	3	1							2	

718AEE07	High Temperature Materials	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

a) To acquaint the student with the fundamentals of creep.
b) To make the student understand about design with creep resistance.
c) To familiarize the student about fracture, cracks and their mechanics.
d) To introduce to the student about oxidation and corrosion in hot environments.
e) To acquaint the student with various super alloys and other materials.

UNIT I CREEP **9 Periods**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II DESIGN FOR CREEP RESISTANCE **9 Periods**

Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monk man-Grant relationship.

UNIT III FRACTURE **9 Periods**

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

UNIT IV OXIDATION AND HOT CORROSION **9 Periods**

Oxidation, Pilling, Bed worth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

UNIT V SUPERALLOYS AND OTHER MATERIALS **9 Periods**

Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallic, high temperature ceramics.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Acquire knowledge of creep and their different stages of creep curve.
b) Understand the mechanical behavior of material rupture life of brittle and ductile.
c) Analyze the concept of fracture and their mechanics due to elevated temperature.
d) Attain the knowledge about oxidation and hot corrosion by addition of alloy elements.
e) Familiarize the various super alloys and other materials.

TEXT BOOKS

1. Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4thEdition, John Wiley, USA, 1996.
2. Courtney T.H, “Mechanical Behavior of Materials”, McGraw-Hill, USA, 1990.

REFERENCES BOOKS

1. Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, UK, 1983.
2. Bressers. J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.
3. McLean D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, USA, 1985.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Acquire knowledge of creep and their different stages of creep curve	2	3		1	1	2	1					2		1	
C02	Understand the mechanical behavior of material rupture life of brittle and ductile	3	2		2	1	1	3		3					1	
C03	Analyze the concept of fracture and their mechanics due to elevated temperature	3	2	3	2	3	3	2			3				1	
C04	Attain the knowledge about oxidation and hot corrosion by addition of alloy elements	3	3		2	2	2	1							1	
C05	Familiarize the various super alloys and other materials	3	3		2	3	3	1							2	

718AEE08	Airworthiness and certification	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Understand the basic concept of aircraft rules and regulations.
b) Know the importance of Airworthiness and certification.
c) Gain knowledge about aircraft maintenance.
d) Understand the concept of flight evolution.
e) Learn the concept of AME License.

UNIT I AIR WORTHINESS AND CERTIFICATION **9 Periods**

Air Worthiness and Continued Air Worthiness, Procedure relating to registration of aircraft; Procedure for issue/ revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness

UNIT II AIRWORTHINESS AND PROCEDURE **9 Periods**

Responsibilities of operators / owners- Procedure of CAR issue, amendments Objectives and targets of airworthiness directorate; Airworthiness regulations and safety oversight of engineering activities of operators list.

UNIT III AIRCRAFT MAINTENANCE **9 Periods**

Investigation, analysis, rectification and defect reporting and monitoring Analytical study of in-flight readings & recordings; Maintenance control by reliability Method. Aircraft maintenance programme & their approval; Maintenance of fuel and oil uplift and consumption records – Light aircraft engines; Fixing routine maintenance periods– Initial & revisions.

UNIT IV HEALTH AND USAGE MONITORING **9 Periods**

On condition of AME License, its classification, experience requirements, Mandatory, Modifications / Inspections. On condition maintenance of reciprocating engines;

UNIT V FLIGHT EVALUATION **9 Periods**

Flight testing of aircraft. Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Use furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit; Procedure for issue of type approval of aircraft components and equipment including instruments.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Explain the Airworthiness requirements for different categories of aircrafts
b) Discuss the various certifications, technical log book
c) Explain the procedure for development, test flight and certification
d) Discuss the accident investigation procedures
e) Explain components and equipment including instruments.

TEXT BOOKS

1. "Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi 2017.
2. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2015.

REFERENCES BOOKS

1. "Aircraft Manual (India) Volume" – Latest Edition, the English Book Store, 17-1Connaught Circus, New Delhi.
2. Advisory Circulars from DGCA 2003.
3. EASA Module- 04 Electrical Fundamental Aviation Maintenance Technician Certification Series.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Explain the Airworthiness requirements for different categories of aircrafts	3	3		1	2	3	1					1		2	
C02	Discuss the various certifications, technical log book	3	3		2	1	1	2		1					1	
C03	Explain the procedure for development, test flight and certification	3	3		3	3	3	1			2				2	
C04	Discuss the accident investigation procedures	3	3		2	2	2	1							1	
C05	Explain components and equipment including instruments	3	3		1	2	2	2							3	

718AEE09	Theory of Plates and Shells	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

- **a)** Acquaint with the classical plate theory.
- **b)** Analyze the plates of various shapes.
- **c)** Learn the concept of eigen value analysis.
- **d)** Get knowledfge on various numerical approximation method for plate analysis.
- **e)** Study about shells and finite difference methods.

UNIT I CLASSICAL PLATE THEORY **9 Periods**

Classical Plate Theory – Assumptions – Differential Equations – Boundary Conditions – Axis-Symmetric Loading.

UNIT II PLATES OF VARIOUS SHAPES **9 Periods**

Navier's Method of Solution for Simply Supported Rectangular Plates – Levy's Method of Solution for Rectangular Plates under Different Boundary Conditions – Annular Plates – Plates of other shapes.

UNIT III EIGEN VALUE ANALYSIS **9 Periods**

Stability and Free Vibration Analysis of Rectangular Plates.

UNIT IV APPROXIMATE METHODS **9 Periods**

Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

UNIT V SHELLS **9 Periods**

Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Explain classical plate theory and boundary conditions
b) Have exposure on various method of solution for different geometry of plates
c) Discuss the various approximate methods to vibration analysis in plates
d) Describe the basic concepts of shell type of structures
e) Understand the behaviour of the plates and shells with different geometry under various types of loads.

TEXT BOOKS

1. Timoshenko, S.P. Winowsky. S., and Kreger, Theory of Plates and Shells, McGraw Hill Book Co., 1990.
2. Varadhan. T. K. &Bhaskar.K., "Analysis of Plates – Theory and Problems", Narosa Publishing House, 2000

REFERENCES BOOKS

1. Flugge, W. Stresses in Shells, Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., Theory of Elastic Stability, McGraw Hill Book Co.1986.
3. Harry Kraus, 'Thin Elastic Shells', John Wiley and Sons, 1987.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Explain classical plate theory and boundary conditions	3	3		3	3	2	2					1		1	
C02	Have exposure on various method of solution for different geometry of plates	3	3		2	1	2	2		2					1	
C03	Discuss the various approximate methods to vibration analysis in plates	3	3		1	1	1	2			3				1	
C04	Describe the basic concepts of shell type of structures	3	3		2	1	2	1							2	
C05	Understand the behaviour of the plates and shells with different geometry under various types of loads	3	3		2	2	2	1							2	

718AEE10	Total Quality Management	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

a) To understand the total quality management concept and principles.
b) To understand the concepts of leadership, customer satisfaction, motivation, Kaizen techniques.
c) To know about six sigma, benchmarking and FMEA concepts.
d) To know about QFD and TPM concepts.
e) To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION **9 Periods**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM - TQM Framework - Philosophies of Deming, Juran and Crosby - Barriers to implement TQM.

UNIT II TQM PRINCIPLE **9 Periods**

Leadership - Strategic quality planning, Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDSA cycle, 5s, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I **9 Periods**

The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II **9 Periods**

Quality circles - Quality Function Deployment (QFD) – House of Quality - Taguchi quality loss function – Total Productive Maintenance - Concepts, improvement needs - Cost of Quality - Performance measures.

UNIT V QUALITY SYSTEMS **9 Periods**

Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 Periods

COURSE OUTCOMES

The students will be able to

a) Get the knowledge on philosophies of management and basic concepts.
b) Explain on knowledge on leadership qualities and management tools of quality statistical concepts.
c) Gain the knowledge about the defect component analysis and quality enhancing technique for practical application.
d) Have exposure on concepts like Quality Function Deployment, Benchmarking, Total Productive Maintenance and Failure Mode Effective Analysis.
e) Learn the knowledge on the Quality certification procedure on ISO 9000, QS14000 and information on Auditing can be obtained.

TEXT BOOKS

1. Dale H.Besterfiled, at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2011.
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,1st Edition, 2011.

REFERENCE BOOKS

1. Poornima M Charantimath, “Total Quality Management”, Pearson Second Edition, 2011.
2. Janakiraman.B and Gopal. R.K, "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd, 2007.
3. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, SouthWestern (Thomson Learning), 2005.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Get the knowledge on philosophies of management and basic concepts	1	2		2	2	3	1					2		1	
C02	Explain on knowledge on leadership qualities and management tools of quality statistical concepts	3	2	2	2	1	1	1		2					2	
C03	Gain the knowledge about the defect component analysis and quality enhancing technique for practical application	2	2		1	1	3	2			2				2	
C04	Have exposure on concepts like Quality Function Deployment, Benchmarking, Total Productive Maintenance and Failure Mode Effective Analysis	2	1		1	1	2	1							1	
C05	Learn the knowledge on the Quality certification procedure on ISO 9000, QS14000 and information on Auditing can be obtained	1	2		1	2	2	2							2	

718AEE11	Principles of Management and Business Concepts	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

a) To gain knowledge on organization structure.
b) To understand the various types of business organizations.
c) To know the modern techniques in controlling.
d) To gain knowledge on various types of business activities.
e) To know about the marketing concepts.

UNIT I OVERVIEW OF MANAGEMENT AND PLANNING **9 Periods**

Definition of Management – Role of managers – Evolution of Management thoughts. Contribution of Taylor and Fayol, Functions of management – Types of business organizations.

Nature and purpose of planning – Planning process – Types of plans – Objectives – Management By Objective (MBO) Strategies – Types of strategies – Policies – Decision Making Process – Forecasting techniques.

UNIT II ORGANIZING AND DIRECTING **9 Periods**

Nature and purpose of organizing – Organization structure – Organization Chart – Formal and informal groups of organization – Line and Staff authority – Depart mentation – Span of control – Centralization and Decentralization – Delegation of authority – Selection and Recruitment – Orientation – Career Development – Career stages – Training – Performance Appraisal.

Creativity and Innovation – Management and Human facts – Motivation – Motivation Theories – Leadership Styles – Leadership theories – Communication – Barriers to effective communication – Electronic Media in Communication.

UNIT III CONTROLLING **9 Periods**

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations, Modern Techniques in Controlling.

UNIT IV BUSINESS ENVIRONMENT **9 Periods**

Nature and purpose of business, classification of business activities: industry, commerce and trade, objectives of business and essentials of successful business, economic environment –basic problems of scarcity and choice, allocation of resources, opportunity cost, Business growth and measurement of size, International Environment-balance of trade, the trade gap and balance of payments, role and methods of trade protectionism, Business Ethics.

UNIT V ELEMENTS OF BUSINESS ACTIVIT **9 Periods**

Purchasing-choosing of suppliers, overview of stock control, production-scale of production, main features of job, mass and batch production systems, Marketing-concept and role of marketing, marketing mix, channels of distribution,

Finance-sources of finance, assessing business performance.

TOTAL : 45 Periods

COURSE OUTCOMES

The students will be able to

a) Describe and discuss the elements of effective management.
b) Know about motivation theories.
c) Gain the knowledge on managerial skills and business activities.
d) Understand the business concepts and its applications.
e) Discuss and apply the planning, organizing and control process.

TEXT BOOKS

1. P C Tripathi and P N Reddy, "Principles of Management", Tata Mc Graw Hill Pvt Ltd, 5th Edition, 2012.
2. Stephen P. Robbins and Mary Coulter, "Management", Pearson Education, 3rdedition, 2011.
3. Joel Dean, "Managerial Economics", Prentice Hall/Pearson, 1992.

REFERENCE BOOKS

1. Philip Kotler, "Marketing Management", Pearson Education, 15th Edition, 2015.
2. Charles W L Hill, Steven L McShane, "Principles of Management", McGraw Hill Education, Special Indian Edition, 2012.
3. Harold Koontz, Heinz Weihrich and Mark V Cannice, "Essentials of Management", Tata McGraw Hill, 9th edition, 2012.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Describe and discuss the elements of effective management	2	3	1	2	2	1	2					2		2	
C02	Know about motivation theories	3	2		2	1	1	1		2					1	
C03	Gain the knowledge on managerial skills and business activities	2	2		2	2	2	1			1				1	
C04	Understand the business concepts and its applications	2	2		2	1	2	1							1	
C05	Discuss and apply the planning, organizing and control process	2	1		2	2	1	2							1	

718MEO02	Non-destructive Testing and Materials	L	T	P	C
		3	0	0	3

PRE-REQUISITES: Knowledge of Manufacturing technology and Material science are required.

COURSE OBJECTIVES

a) To understand principle behind various NDT techniques.
b) To study about NDT equipments and accessories.
c) To learn working procedures of various NDT techniques.
d) To know the applications and recent trends in NDT.
e) To know about the NDT techniques for flaw detection.

UNIT I INTRODUCTION AND VISUAL INSPECTION TECHNIQUE **9 Periods**

Introduction to various non-destructive methods – Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING **9 Periods**

Physical principles, procedure for penetrant testing, Characteristics of penetrants - Developers, Penetrant testing methods – Applications, Principle of MPT, Magnetising technical and procedure used for testing a component, Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING **9 Periods**

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications - Principle of AET, AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING **9 Periods**

Introduction, Principle of operation, Types of Ultrasonic propagation – Ultrasonic probes. Types of Ultrasonic Transducers – Testing Techniques and Inspection methods – Pulse Echo, ABC scans, Transmission angle beam, Testing procedures and its applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS **9 Periods**

Basic principle, Effect of radiation of Film, Radiographic Imaging – Inspection Techniques – Single wall single image, Double wall Penetration & Multiwall Penetration technique – Comparison and selection of various NDT techniques.

TOTAL : 45 Periods

COURSE OUTCOMES

The students will be able to

a) Apply scientific and technical knowledge to the field of non-destructive testing.
b) Use the relevant non-destructive testing methods for various engineering practice.
c) Analyse and interpret the defects to improve the overall quality of products.
d) Develop their skills in inspection of the components.
e) Increase overall reliability of the products by selection of suitable inspection techniques.

TEXT BOOKS

1. J Prasad, and CGK Nair, "Non Destructive Testing and Evaluation of materials", Tata McGraw Hill, 2017.
2. Ravi Prakash, "Non Destructive Testing Techniques", New Age International, 1st Edition revised, 2010.

REFERENCE BOOKS

1. Baldev Raj and B.Venkataraman, "Practical Radiology", Narosa Publishing House, 2004.
2. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non-Destructive Tesitng" Narosa Publishing house, New Delhi, 2002.
3. Krautkramer.J, "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Apply scientific and technical knowledge to the field of non-destructive testing	3	3		3	3	2	2					1		1	
C02	Use the relevant non-destructive testing methods for various engineering practice	3	3		2	1	2	2		2					1	
C03	Analyse and interpret the defects to improve the overall quality of products.	3	3		1	1	1	2			3				1	
C04	Develop their skills in inspection of the components	3	3		2	1	2	1							2	
C05	Increase overall reliability of the products by selection of suitable inspection techniques	3	3		2	2	2	1							2	

718AEE013	Robotics and Automation	L	T	P	C
		3	0	0	3

Pre – Requisite: Transducers Engineering, Process Dynamics and Control

COURSE OBJECTIVES

The students will be able to

a) To study the various parts of robots and fields of robotics.
b) To study the various kinematics and inverse kinematics of robots.
c) To study the Euler, Lagrangian formulation of Robot dynamics.
d) To study the trajectory planning for robot.
e) To study the control of robots for some specific applications.

UNIT I BASIC CONCEPTS AND END EFFECTORS **9 Periods**

Automation and Robotics – Robot Anatomy – classification of Robots by configuration –– position and force control – basic Components of Robots system – manipulators, wrists, end effectors –classification of grippers –types of grippers–methods for orientation and location of objects.

UNIT II POWER SOURCE **9 Periods**

Hydraulic, pneumatic and electric drives –and gearing ratio – machine vision – ranging – laser range finder – torque sensors –touch sensors- proximity sensors-light sensors-elements of wrist sensors- fiber optic and tactile sensors-image processing and analysis.

UNIT III KINEMATICS AND PATH PLANNING **9 Periods**

Solution of direct and inverse kinematics problem – Robot trajectories–path trajectories, joint space trajectories– multiple robots - Jacobian work envelope - Robot cycle time analysis

UNIT IV ROBOT PROGRAMMING AND LANGUAGES **9 Periods**

Robot languages and classification-Methods of Robot programming – lead through programming methods – robot program as a path in space – motion interpolation – weight, signal and delay commands – Branching capabilities –– Robot programming examples for pick and place application using VAL-ARC welding program-point to point path robot and to protruding in a pallet object-MCL Language.

UNIT V CASE STUDIES AND APPLICATIONS **9 Periods**

Robots in manufacturing and non-manufacturing application – robot cell design – selection of robot - factory automation – FMS and CIM. Application of robots in material handling, processing operations, assembly and inspection –– future applications of robots-application of artificial intelligence robot.

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Analyzing the various parts of robots and fields of robotics.
b) Understanding the various kinematics and inverse kinematics of robots.
c) Determining the Euler, Lagrangian formulation of Robot dynamics.
d) Understanding the basic concepts of the trajectory planning for robot.
e) Understanding the Application of robot.

TEXT BOOKS

1. Fu, K.S., Gonzalez RC., and Lee C.S.G., "Robotics control, sensing, vision and intelligence," McGraw Hill, 1987.
2. Mikell P. Groover, MilchelWein Roger Nagel and Nicholas G. Ordy, "Industrial Robotics, Technology, Programming and Applications", McGraw Hill, Last Print, 2005.

REFERENCE BOOKS

1. Deb.S.R, "Robotics Technology and Flexible Machine Design", Tata McGraw Hill, 2005.
2. JankaiRaman "Robotics and Image processing" Tata McGraw Hill, 1995.
3. Ganesh S.Hegde "A text book on Industrial Robotics". LaxmiPublictions, 2006.

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Analyzing the various parts of robots and fields of robotics	3	3		3	3	2	2					1		1	
C02	Analyzing the various parts of robots and fields of robotics	3	3		2	1	2	2		2					1	
C03	Determining the Euler, Lagrangian formulation of Robot dynamics	3	3		1	1	1	2			3				1	
C04	Understanding the basic concepts of the trajectory planning for robot	3	3		2	1	2	1							2	
C05	Understanding the Application of robot	3	3		2	2	2	1							2	

718AEE14	Industrial engineering and Management	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Understand the basic concept of the industrial management and techniques of decision making.
b) Understand the basic concept of customer involvement.
c) Understand the basic concept of work-study.
d) Understand the basic concept of incentive schemes.
e) Understand the basic concept of process improvement, the role of staffing, work study, incentives health and safety in management.

UNIT I INTRODUCTION **9 Periods**

Historical perspective, contribution of Taylor, Henry Fayol, Gilbert, Charles Babbage, Henry Gantt to the evolution of management science in the Indian context. Ownership of Industries Proprietorship, partnership, joint stock companies, public and private undertakings, co-operative organizations

UNIT II WORK STUDY, INCENTIVES, HEALTH AND SAFETY **9 Periods**

Work study-Motion study and Method time study, principles of motion economy, charts and diagrams, Job evaluation systems, Multi skilling, Wage payment and plans, Incentive schemes, Training and Development, Safety Regulations and safe practices.

UNIT III MOTIVATION AND BEHAVIOR **9 Periods**

Hawthorns studies and its findings Maslow's theory X and Y theory, Immaturity theory motivation hygiene theory, Pretence of needs and satisfaction of needs, goal oriented behavior, integration of organizational goals and needs of employee.

UNIT IV MANAGEMENT AND BEHAVIORAL APPROACH **9 Periods**

Contribution of Elton Mayo and Skinner to behavior sciences. Skills of a manager at various levels in an organization and inter-related systems, understanding past behavior, predicting future behavior, directing, changing and controlling behavior.

UNIT V PROCESS MANAGEMENT **9 Periods**

Definition of process management. Major process decisions-process choice, vertical integration, resource flexibility, customer involvement, capital intensity, relationships between decisions, service operation, economics of scoop and gaining focus. Designing process-process rearranging and process improvement

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Recall the history and describe the various management functions.
b) Identify the role of staffing, work study, incentives, health and safety in management.
c) Apply techniques of decision making, customer involvement, work-study, incentive schemes and process improvement.
d) Describe the various management behavioural technique.
e) Have exposure on the various process improvement technique.

TEXT BOOKS

1. Principles of Management, Koontz O Donnel,"Mc.Graw Hill Intl.Book Co.2016
2. Statistical Quality Control: E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher. 2018

REFERENCE BOOKS

1. Essentials of management, Koontz Weirich, TATA McGraw Hill Intl. Book Co., 7th Edition.2012
2. Management of Organizational Behavior, Hersey Paul and Kenneth H," PHI.2013
3. Operations management-strategy and analysis, LeeJ.Krajewski and Larry P. Ritzman, Fifth Edition Addison-Wiley. 2009

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Recall the history and describe the various management functions	3	2		1	1	2	1					1		1	
C02	Identify the role of staffing, work study, incentives, health and safety in management	3	2		1	1	2	1		2					1	
C03	Apply techniques of decision making, customer involvement, work-study, incentive schemes and process improvement	3	2		2	1	1	3			1				1	
C04	Describe the various management behavioural technique	3	2		2	1	2	1							1	
C05	Have exposure on the various process improvement technique	3	2		2	1	1	2							1	

718AEP09	Aerospace computational analysis laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE

a) To provide the knowledge on various structural analysis software packages
b) To impart the understanding of the stress analysis of different types of structural components
c) To impart the Knowledge on programming for various structural analysis
d) To provide the knowledge on buckling analysis
e) To provide the knowledge on vibration analysis of bar

LIST OF EXPERIMENTS

1. Static stress analysis axial bar
2. Two dimensional (truss) frame with multiple materials and element type's
3. Three dimensional truss- Airframe
4. Simple two dimensional heat transfer problem
5. Modal analysis of Aircraft wing
6. Plate buckling analysis
7. Box Beam- Torsional and bending problem.
8. Fluid-structure interaction-Oscillating plate using Ansys workbench.
9. Programming of one dimensional bar with single material and axial loading
10. Programming of one dimensional step bar, multiple material with different axial loading

TOTAL: 45 Periods

COURSE OUTCOME

Students will be able to

a) Understand the various structural software packages
b) Solve the static structural analysis of one dimensional members
c) Solve the static structural analysis of two dimensional & three dimensional problem
d) Analyze the Static Thermal analysis of various objects
e) Understand the various structural programming – open source software packages and Program for various structures problem

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl.No	Items	Quantity
1.	Systems	30 per batch

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Understand the various structural software packages	3	2			1		1					1		1	
C02	Solve the static structural analysis of one dimensional members	3	2			2	2	1		1					1	
C03	Solve the static structural analysis of two dimensional & three dimensional problem	3	2		1		1	1			1				1	
C04	Analyze the Static Thermal analysis of various objects	3	2			1	1	1							1	
C05	Understand the various structural programming – open source software packages and Program for various structures problem	3	2		2	2	1	1							1	

718AEP10	CFD laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE

a) To familiarize the students with the working of CFD codes
b) To familiarize the students with actual setting up of the problem and solution procedure
c) To extract the required data, post process and compare with available data
d) To familiarize the students with Flat Plate Boundary Layer
e) To familiarize the students with flow over a wedge

LIST OF EXPERIMENTS

1. Laminar Pipe Flow
2. Turbulent Pipe Flow
3. Modelling a mixing Elbow (2-D)
4. Flat Plate Boundary Layer
5. Forced Convection over a Flat Plate
6. Steady Flow past a Cylinder
7. Unsteady Flow past a Cylinder
8. Flow Over an Airfoil
9. Flow simulation over an aircraft
10. Flow simulation over a rocket
11. Supersonic Flow over a Wedge
12. Compressible Flow in a Nozzle
13. Analysis of 1D unsteady conduction by explicit and implicit schemes.

TOTAL: 45 Periods

COURSE OUTCOME

Students will able to

a) Define the body shape in a CFD code
b) Create the solution domain and grid generation
c) Apply boundary conditions and generate the solution
d) Validate the aerodynamic quantities from computed data
e) Perform CFD Analysis over 2D and 3D objects and solve the problems using different turbulence models.

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl.No	Items	Quantity

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Define the body shape in a CFD code	3			1		3	1					1		1	
C02	Create the solution domain and grid generation	2			2		3	1		2					1	
C03	Apply boundary conditions and generate the solution	1			1		2	3			3				1	
C04	Validate the aerodynamic quantities from computed data	2			2		2	1							1	
C05	Perform CFD Analysis over 2D and 3D objects and solve the problems using different turbulence models	1			3		1	3							1	

718AEP11	Autonomous UAV Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE

a) Recognize and describe the role of unmanned aerial vehicles (UAVs) in past, present, and future society.
   Comprehend and explain various components of UAVs
b) Comprehend and explain basics of flight and flight control systems
c) Understand and describe basic regulations applicable to UAV flight
d) Understand and describe analysis of electric systems
e) Understand the concept on internal combustion engines

LIST OF EXPERIMENTS

1. Study of lift generation method
2. Analysis of LOS / BLOS
3. Study of ethical implications
4. Analysis of electric systems
5. Study of Unmanned Aerial System propulsion
6. Analysis of on-board flight control
7. Study of internal combustion engines
8. Analysis of sensing / surveillance
9. Study of turbine engines
10. Building a working model of UAV flight

TOTAL: 45 Periods

COURSE OUTCOME

Students will able to

a) Define the working of a UAV system
b) Create the electrical system for UAV
c) Apply sensing and surveillance
d) Perform sensing and surveillance using a UAV flight
e) Solve issues of a UAV system

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Define the working of a UAV system	3	2			1	1						1		1	
C02	Create the electrical system for UAV	3	2			2	2	2							1	
C03	Apply sensing and surveillance	2	2			2	3					1			1	
C04	Perform sensing and surveillance using a UAV flight	2	3			2	3	1							1	
C05	Solve issues of a UAV system	3	2			2	3								1	

718AEP12	Industrial internship	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE

a) Engage and motivate student learning.
b) Connect academic concepts and knowledge to skills and responsibilities required for various careers.
c) Develop occupational and employment skills and habits.
d) Contributes to an understanding of how a business/professional organization operates.
e) Allows student access and a chance to become acclimated to various work environments.
f) Establishes desirable work habits, attitudes, and communication skills while developing a sense of responsibility

LIST OF EXPERIMENTS

1. Introduction to professional industrial internship program.
2. Planning of industrial internship program.
3. Dos and Don'ts during an industrial internship program.
4. Time management and document management activities.
5. Essential qualification skills to perform a role.
6. Role playing as an administrator and select the students who fit the roles.
7. Required forms and other official documents to undergo industrial internship.
8. Role playing as a coordinator of industrial internship.
9. Responsibilities to be as an administrator.
10. Handling of critical and stressful situations.

TOTAL: 45 Periods

COURSE OUTCOME

Students will able to

a) Undergo and organize an industrial internship.
b) Handle stressful and critical situation.
c) Efficiently interact with the industry.
d) Efficient decision making
e) Responsibility of administrator

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Undergo and organize an industrial internship	3	3		3	3	2	2					2		1	
C02	Handle stressful and critical situation	3	3		2	3	1	1		2					1	
C03	Efficiently interact with the industry	3	3		3	1	1	2			2				1	
C04	Efficient decision making	3	3		2	3	2	1							1	
C05	Responsibility of administrator	3	3		3	2	1	2							1	

718AEP13	Employability skills laboratory	L	T	P	C
		0	0	2	2

COURSE OBJECTIVES

a) To facilitate computer-aided multi-media instruction enabling individualized and independent language
Learning
b) To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
c) To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
d) To improve the fluency in spoken English and neutralize mother tongue influence
e) To train students to use language appropriately for interviews, group discussion and public speaking

LIST OF EXPERIMENTS

1. Situational Dialogues – Role-Play- Expressions in Various Situations
2. Self-introduction and Introducing Others
3. Greetings – Apologies – Requests
4. Social and Professional Etiquette - Telephone Etiquette.
5. Words often misspelt- confused/misused.
6. Perform group discussion.
7. Job Application with Resume preparation.
8. Role play as interviewer and interviewee
9. Neutralization of Mother Tongue Influence and Conversation Practice 10. Critical situation handling

TOTAL: 45 Periods

COURSE OUTCOMES

a) Better Understanding of nuances of language through audio- visual experience and group activities
b) Neutralization of accent for intelligibility
c) Speaking with clarity and confidence thereby enhancing employability skills of the students
d) Better understanding of decision making
e) To know relationship between top level management and labors

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl.No	Items	Quantity
1.	Systems	30 per batch

Course outcome		Ps 01	Ps 02	Ps 03	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12
C01	Better Understanding of nuances of language through audio- visual experience and group activities	2	3		2	3	2	2								
C02	Neutralization of accent for intelligibility	2	3		2	2	2	2		1					1	
C03	Speaking with clarity and confidence thereby enhancing employability skills of the students	3	3		1	2	1	2			1				1	
C04	Better understanding of decision making	3	3		1	1	2	1								
C05	To know relationship between top level management and labors	2	3		3	1	2	2							2	

818AET01 **Rocket and Missiles**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Understand the Fundamentals and uses of solid, liquid and hybrid propellants in rocket systems.
b) Describe the drag and lift forces acting on rocket and missile.
c) Predict the solid rocket motors to achieve specific missile mission goals.
d) Understand the launch vehicle booster rocket systems and its separation techniques.
e) Gain the knowledge about selection of materials in rockets and missiles.

UNIT I ROCKETS SYSTEMS **9 Periods**

Ignition System in rockets – Types of Igniters – Igniter Design Considerations – Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems – Propellant Slash and Propellant Hammer - Elimination of Geysering Effect in Missiles – Combustion System of Solid Rockets.

UNIT II AERODYNAMICS OF ROCKETS AND MISSILES **9 Periods**

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation – Body Up wash and Downwash in Missiles – Numerical Problems.

UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD **9 Periods**

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT IV STAGING AND CONTROL OF ROCKETS AND MISSILES **9 Periods**

Rocket Vector Control – Methods – Thrust determination – SITVC – Multistaging of rockets – Vehicle Optimization – Stage Separation Dynamics – Separation Techniques.

UNIT V MATERIALS FOR ROCKETS AND MISSILES **9 Periods**

Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

TOTAL: 45 Periods

COURSE OUTCOMES

On successfully completing of this course, students will be able to

a) Design Consideration of liquid Rocket Combustion Chamber and Igniter.
b) Acquire the knowledge about Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket.
c) Learn about the 1D and 2D rocket Motions in Free Space and Homogeneous Gravitational Fields.
d) Understood the Vertical, Inclined and Gravity Turn Trajectories in rocket motion and also the rockets Separation Techniques.
e) Familiarize with the selection of suitable materials for different rocket systems

TEXT BOOKS

1. George Sutton “Rocket Propulsion and Space Dynamics”, Wiley India Pvt.ltd. Mar 2010.
2. Martin J. L. Turner, Rocket and Spacecraft Propulsion Principles, Practice and New Developments (Third Edition), Springer Berlin Heidelberg New York 2009.

REFERENCE BOOKS

1. Ronald Flock “Gas Turbines and Jet and Rocket Propulsion”, Cambridge University press, Jan 2011.
2. Bill yenne “Principles of Guided Missile Design”, Creasy publishing 2012.
3. George M Siouris, “Missile guidance and control systems” Springer, 2004.

Course Outcome		PSO 1	PSO 2	PSO 3	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Co1	Design Consideration of liquid Rocket Combustion Chamber and Igniter	3	1		3	2	3	1	3						1	
Co2	Acquire the knowledge about Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket	3	2		2	3	3	1	3	3	2		3		1	
Co3	Learn about the 1D and 2D rocket Motions in Free Space and Homogeneous Gravitational Fields	2	1		2	2	3	1	2		1				2	
Co4	Understood the Vertical, Inclined and Gravity Turn Trajectories in rocket motion and also the rockets Separation Techniques	3	1		3	2	2	1	3			2	3		1	
Co5	Familiarize with the selection of suitable materials for different rocket systems		2		3	2	2	1	3	3					2	

818AEE02	Total Quality Management	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) To understand the total quality management concept and principles.
b) To understand the concepts of leadership, customer satisfaction, motivation, Kaizen techniques.
c) To know about six sigma, benchmarking and FMEA concepts.
d) To know about QFD and TPM concepts.
e) To create an awareness about the ISO and QS certification process.

UNIT I INTRODUCTION **9 Periods**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM - TQM Framework - Philosophies of Deming, Juran and Crosby - Barriers to implement TQM.

UNIT II TQM PRINCIPLE **9 Periods**

Leadership - Strategic quality planning, Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDSA cycle, 5s, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I **9 Periods**

The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II **9 Periods**

Quality circles - Quality Function Deployment (QFD) – House of Quality - Taguchi quality loss function – Total Productive Maintenance - Concepts, improvement needs - Cost of Quality - Performance measures.

UNIT V QUALITY SYSTEMS **9 Periods**

Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM implementation in manufacturing and service sectors including IT.

COURSE OUTCOMES **TOTAL: 45 Periods**

On successful completion of this course, students should be able to

a) Get the knowledge on philosophies of management and basic concepts.
b) Gain the knowledge on leadership qualities and management tools of quality statistical concepts.
c) Gain the knowledge about the defect component analysis for practical application.
d) Have exposure on concepts like Quality Function Deployment, Benchmarking etc.
e) Gain the knowledge on the Quality certification procedure on ISO 9000, QS14000.

TEXT BOOKS

1. Dale H.Besterfiled, at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2011.
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,1st Edition, 2011.

REFERENCE BOOKS

1. Poornima M Charantimath, “Total Quality Management”, Pearson Second Edition, 2011.
2. Janakiraman.B and Gopal. R.K, "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd, 2007.
3. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Get the knowledge on philosophies of management and basic concepts	3	1		3	2	3	2	3				3		1	
Co2	Gain the knowledge on leadership qualities and management tools of quality statistical concepts	3	1	2	1	2	3	2	3			2			1	
Co3	Gain the knowledge about the defect component analysis for practical application	3	2		3	2	2	1	2			2	3		1	
Co4	Have exposure on concepts like Quality Function Deployment, Benchmarking etc	3	1		1	2	3	1	1	1					1	
Co5	Gain the knowledge on the Quality certification procedure on ISO 9000, QS14000	3	2		3	2	2	1	3			2			1	

818AEE03	Computer Integrated Manufacturing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) To impart knowledge about the integration of interdisciplinary fields of computer aided design.
b) To design and analysis various automatic material handling systems.
c) To make the students aware about various techniques of data collection.
d) To understand about the cellular technology.
e) To understand the application of robotics in industry.

UNIT I INTRODUCTION **9 Periods**

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production - Manufacturing models and Metrics – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production

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UNIT II PRODUCTION AND PROCESS PLANNING **9 Periods**

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III CELLULAR MANUFACTURING **9 Periods**

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems**.**

UNIT IV FLEXIBLE MANUFACTURING SYSTEM AND VEHICLE GUIDANCE **9 Periods**

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management &Safety.

UNIT V INDUSTRIAL ROBOTICS **9 Periods**

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

COURSE OUTCOMES **TOTAL: 45 Periods**

On successful completion of this course, students should be able to

a) Solve the design problems of different type of transfer mechanism.
b) Perform design and analysis of automatic storage and retrieval system.
c) Evaluate the space requirements of different storage system.
d) Design the workstation requirement for unattended operations and automated production system.
e) Optimize the number of machines required for machine cell in a given production system.

TEXT BOOKS

1. Vajpayee, K.S., Principles of Computer Integrated Manufacturing, Prentice Hall 2006.
2. Rao, P. N.,Tewari, N. K. and Kundra, T. K., Computer Integrated Manufacturing, McGraw Hill 1998.

REFERENCE BOOKS

1. Groover, M. P. and Zimmers, E. W., CAD/ CAM, Dorling Kingsley.,2008.
2. Groover, M. P., Automation, Production systems and Computer Integrated Manufacturing, Pearson Education Asia.,2009.
3. "Computer Integrated Manufacturing: Current Status and Challenges" by Kiyoji Asai and I Burhan Turksen.,2008.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Solve the design problems of different type of transfer mechanism	3	1		3	2	3	1	3			1			1	
Co2	Perform design and analysis of automatic storage and retrieval system	3	1		3	2	2	1	1						1	
Co3	Evaluate the space requirements of different storage system	3	2		3	2	3	2	3			3			1	
Co4	Design the workstation requirement for unattended operations and automated production system	3	1		3	2	3	1	2	2		1	3		1	2
Co5	Optimize the number of machines required for machine cell in a given production system	3	2		3	2	3	1	3					2	1	

818AEE04	Entrepreneurship Development, Management & IPR	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) To provide an introduction to entrepreneurship and its development process
b) To learn about business idea generation and preparation of business plan
c) To make student understand various activities of funding agencies
d) To provide conceptual clarification to family business
e) To provide conceptual clarification networking, e- business and growth strategies.

UNIT I INTRODUCTION OF ENTREPRENEURSHIP 9 Periods

Introduction-meaning and importance of entrepreneurship, entrepreneur, types, characteristics entrepreneur process, role of entrepreneurs in economic development, problems faced by entrepreneurs, scope in India.

UNIT II ENTREPRENEURIAL DEVELOPMENT -AGENCIES 9 Periods

Micro, Small and medium enterprises, Definition of MSMEs as per MSME act, characteristics of small enterprises, need and advantages of small enterprises, Steps in setting up of small enterprises, Institutional support to MSMEs-State supporting agencies-TECSOK, KIADB, KSSIDC, KSFC, National Schemes-MSME-DI, NSIC, SIDBI.

UNIT III PROJECT MANAGEMENT 9 Periods

Preparation of Project reports, control variables in project, project lifecycle, project report, need, project identification, project selection, components of project report, formulation of report, planning commission guidelines, project appraisal, feasibility study-market, financial, technical and economic, PERT and CPM, errors in report.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY 9 Periods

Introduction to IP, What is Intellectual Property (IP), Historical background of IP, Economic value of IP, Motivation to IP development, IP system strategy, Emerging issues, IPR governance, Institutions for administering the IP system, IP rights and marketing regulations, IPR protection, protecting consumers and protecting competition .

UNIT V PATENT RIGHTS 9 Periods

TRIPS and its implications Patents-What is a patent, history of patent, Criteria for patent, types of patents, Indian patent act, patents for computer software, business models, incremental innovation, patent infringement

COURSE OUTCOMES TOTAL: 45 Periods

On successful completion of this course, students should be able to

a) Recognize the importance of entrepreneurship and its role in economic development.
b) Identify various schemes of Central and State Governments and their agencies.
c) Identify & select various projects to become entrepreneur by feasibility studies
d) Prepare project report for starting an enterprise in line with guidelines.
e) Appraise of IP rights like patents, industrial design for effective protection

TEXT BOOKS

1. Vasanta Desai,"Dynamics of entrepreneurial development and management",2009
2. Peter F. Drucker," Innovation and development" 2006.

REFERENCE BOOKS

1. M.V.Deshpande" Entrepreneurship of small scale industries",2003
2. Batra, G.S., Development of Entrepreneurship, Deep and Deep Publications, New Delhi, 2003.
3. Carter and Jones Evans, Enterprise and Small Business: Principles Practice and Policy, Prentice Hall Publications, New Delhi, 2000.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Recognize the importance of entrepreneurship and its role in economic development	3	1		3	3	3	1	2	2				2	1	
Co2	Identify various schemes of Central and State Governments and their agencies	3	2		3	1	2	2	3		2		3		1	
Co3	Identify & select various projects to become entrepreneur by feasibility studies	3	1	2	2	2	3	1	3			1	2		1	3
Co4	Prepare project report for starting an enterprise in line with guidelines	3	1	2	3	3	3	1	3			2			3	
Co5	Appraise of IP rights like patents, industrial design for effective protection	3	2		2	2	3	1	2		3		2		1	

818AEE05	Computer Aided Design/Computer Aided Manufacturing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students should be able to

a) Understand the basic fundamentals of computer aided design and manufacturing.
b) To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
c) To understand the different geometric modeling techniques like solid modeling, feature based modeling etc.
d) To learn the part programming, Computer aided process planning & Computer aided quality control.
e) To learn the overall configuration and elements of computer integrated manufacturing

UNIT I INTRODUCTION **9 Periods**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices and storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations and surface removal.

UNIT II GEOMETRIC MODELING **9 Periods**

Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

UNIT III DRAFTING, MODELING SYSTEMS AND NUMERICAL CONTROL **9 Periods**

Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT IV GROUP TECHNOLOGY **9 Periods**

Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type

UNIT V COMPUTER AIDED QUALITY CONTROL **9 Periods**

Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-non optical, computer aided testing, integration of CAQC with CAD/CAM.

Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

COURSE OUTCOMES **TOTAL: 45 Periods**

On successful completion of this course, students should be able to

a) Select Input and Output Devices for Computer Systems for Requirements.
b) The learning outcomes are assessed through the assignments.
c) Apply Knowledge of Mathematical Concept For Geometry Manipulation.
d) Operate CAD/CAM Packages to Prepare Solid Model of Components.
e) Develop Computer Algorithm for Design and Analysis of Mechanical Systems

TEXT BOOKS

1. Ibrahim Zeid "CAD / CAM Theory and Practice" TMH Publishers 2009.
2. Zimmers & P.Groover "CAD / CAM" Prentice Hall. Release Date: December 1983.

REFERENCE BOOKS

1. Radhakrishnan and Subramanian .,"CAD / CAM / CIM " New Age Publishers,2008
2. Farid Amirouche .,Pearson.,"Principles of Computer Aided Design and Manufacturing ,2004.
3. Warren S Seames Thomson Publishers.,"CAD/CAM: Concepts and Applications "Alavala PHI Publishers Computer Numerical Control Concepts and programming 2003.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Select Input and Output Devices for Computer Systems for Requirements	3	1		3	1	3	1	3			2			1	
Co2	The learning outcomes are assessed through the assignments	2	1		3	2	3	1	2						2	
Co3	Apply Knowledge of Mathematical Concept For Geometry Manipulation	3	3		3	3	3	1	3		2		3		2	
Co4	Operate CAD/CAM Packages to Prepare Solid Model of Components.	3	1		3	2	3	1	3		1				2	
Co5	Develop Computer Algorithm for Design and Analysis of Mechanical Systems	3	2		3	2	3	1	3						1	

818AEE06	Human Values and Professional Ethics	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students should be able to

a) Distinguish the morality, integrity, honesty and spirituality.
b) Explain the various theory which portray about the engineering ethics.
c) Illustrate the industrial standard and responsibility of engineers.
d) Discover the safety and rights of human in the working place.
e) Drive the professional to aware of the global issues in the technological society

UNIT I HUMAN VALUES **9 Periods**

Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS **9 Periods**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry – moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9 Periods**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics –industrial standards- a balanced outlook on law - the challenger case study

UNIT IV SAFETY- RESPONSIBILITIES AND RIGHTS **9 Periods**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies- Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest – occupational crime - professional rights - employee rights-IPR-discrimination.

UNIT V GLOBAL ISSUES **9 Periods**

Multinational corporations -Corporate Social responsibility- Environmental ethics - computer ethics – weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME- ASCE- IE- E-E- Institution of Engineers (IEI) India- Institution of Electronics and Telecommunication engineers(IETE) India

TOTAL: 45 Periods

COURSE OUTCOMES

On successful completion of this course, students should be able to

a) Extrapolate and make awareness on the morality, integrity, honesty and spirituality.
b) Judgment and assistance based on the ethical theory to tackle the moral issues.
c) Professional reputation is witnessed due to the balanced outlook on law.
d) Develop safety and responsibilities for the development of the employee.
e) Drive to be a moral leader with the analysis of the global issues in the engineering society.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger- “Ethics in Engineering”- Tata McGraw-Hill- - 1996-3
2. Govindarajan M- Natarajan S- Senthil Kumar V- S- “Engineering Ethics”- Prentice Hall of India- New Delhi- 2004.

REFERENCE BOOKS

1. R-S Nagarazan "A textbook on Professional Ethics and Human Values" New Age International Publishers- New Delhi 2006.
2. Charles E Harris- Michael S- Protchard and Michael J Rabins- "Engineering Ethics – Concepts and Cases"- Wadsworth Thompson Learning- United States- 2000.
3. John R Boatright- "Ethics and the Conduct of Business"- Pearson Education- New Delhi- 2003.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Extrapolate and make awareness on the morality, integrity, honesty and spirituality	3	1		3	2	3	1	3		1				1	2
Co2	Judgment and assistance based on the ethical theory to tackle the moral issues	3	1		3	2	3	2	3						3	
Co3	Professional reputation is witnessed due to the balanced outlook on law	3	2	2	3	2	3	1	2	3	1		3	2	1	
Co4	Develop safety and responsibilities for the development of the employee	3	1		3	2	3	1	2				3		2	3
Co5	Drive to be a moral leader with the analysis of the global issues in the engineering society		2		2	2	3	1	3	3		2			1	3

818AEE07	Operation Research	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Students will able to**,**

a) The industrial management and techniques of decision making, customer involvement, work-study, incentive schemes.
b) The process improvement, the role of staffing, work study, incentives, health and safety in management.
c) The queuing system and their characteristics.
d) The network construction and other network related topics.
e) The formulation of games and graphical solutions and dominance property.

UNIT I LINEAR PROGRAMMING **9 Periods**

Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods.

UNIT II TRANSPORTATION PROBLEM **9 Periods**

Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Traveling salesman problem.

UNIT III SEQUENCING & QUEUING THEORY **9 Periods**

Johnson's algorithm, n - jobs to 2 machines, n jobs 3machines, n jobs m machines without passing sequence. 2 jobs n machines with passing. Graphical solutions priority rules.

Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model.

UNIT IV PERT-CPM TECHNIQUES **9 Periods**

Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks.

UNIT V GAME THEORY **9 Periods**

Formulation of games, Two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property

Total:45 periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Recall the history and describe the various management functions.
b) Identify the role of staffing, work study, incentives, health and safety in management.
c) Apply techniques of decision making, customer involvement, work-study, incentive schemes and process improvement.
d) Describe the various management behavioral technique.
e) Acquire the knowledge about graphical solution for all the problems.

TEXT BOOKS

1. S. D. Sharma –Kedarnath Ramnath& Co Operations Research, Publishing House Private Limited 2002.
2. F S Hiller and G J Leiberman "Introduction to Operations Research" Publisher: newagepublishers second edition , 2009

REFERENCE BOOKS

1. AM Natarajan, P. Balasubramani, ATamilaravari "Operation Research" Khanna Book Publishing, New Delhi 2005
2. Hiller and liberman, McGraw Hill Introduction to operation research, Himalaya Publishing House Private Limited. 5th edition 2001.
3. Ravindran, Phillips & Solberg, Wiley Operations Research: Principles and practice: Publisher: Tata Mcgraw Hill. 2nd Edition 2007

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Recall the history and describe the various management functions	3	1		3	2	3	1	3	1					1	
Co2	Identify the role of staffing, work study, incentives, health and safety in management	3	1	1	3	2	2	2	3		1			3	1	2
Co3	Apply techniques of decision making, customer involvement, work-study, incentive schemes and process improvement	3	2	3	3	2	3	1	2	2		2	3		2	2
Co4	Describe the various management behavioral technique	3	1		3	2	3	1	3		2		2		2	
Co5	Acquire the knowledge about graphical solution for all the problems	3	2		3	2	3	1	3	1		1	3		1	

818AEE08	Combustion	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) The concepts of air transportation and the maintenance management of aircraft.
b) The principles of chemical kinetics and chemical equilibrium.
c) The concepts of engines and combustion system of engines.
d) The principles of combustion in rocket engines.
e) The pollutants and methods of reducing pollutants

UNIT I REVIEW OF BASIC CONCEPTS **9 Periods**

Laws of thermodynamics, Multi-component mixtures, simple thermo chemical equations and heat of combustion, properties of real gases, transport phenomena, Rankine -Hugoniot curves, ideas of deflagration and detonation.

UNIT II CHEMICAL EQUILIBRIUM AND KINETICS OF DIFFUSION FLAMES **9 Periods**

Concept of chemical equilibrium in multicomponent mixtures, Elements of adiabatic flame temperature calculation, Chemical kinetics – rates and order of reactions, Reaction mechanism and chain reactions. Differences between premixed and diffusion flames, gas diffusion flames in parallel flow – jet flames and Burke Schumann flames, Liquid droplet combustion.

UNIT III COMBUSTION IN PISTON & GAS TURBINE ENGINES **9 Periods**

Review of operation of reciprocating engines, Description of the combustion process in piston engines, Combustion efficiency and factors affecting it, detonation in reciprocating engines and preventive methods. Description of different types of combustion chambers in gas-turbine engines, primary requirements of the combustor, Flow structure, recirculation and flame stabilization in main combustion chamber, afterburners.

UNIT IV COMBUSTION IN ROCKET ENGINES **9 Periods**

Combustion of carbon particle, boundary layer combustion, basic principles of combustion solid propellants, extension of droplet combustion to liquid propellant rockets

UNIT V EMISSIONS **9 Periods**

Flame radiation, pollutants - unburnt hydrocarbons, oxides of nitrogen and carbon monoxide, methods of reducing pollutants, Principle of exhaust gas analysis.

Total: 45 periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Familiar with the concepts of air transportation and the maintenance management of aircraft.
b) Apply the chemical kinetics and chemical equilibrium.
c) Describe the concepts of engines and combustion system of engines.
d) Apply the principles of combustion of rocket engines.
e) The students will acquire knowledge about pollution and reduction of pollutants.

TEXT BOOKS

1. Stephen Turns TATA mcgraw hill “Introduction to Combustion” Khanna Book Publishing, New Delhi. Third edition, 2009.
2. J R Bowen and J C Leyer “Dynamics of Reactive Systems: Part 1: Flames and Configurations; Part 2: Modeling and Heterogeneous Combustion” scitech publications india pvt, 2008

REFERENCE BOOKS

1. G. Singer, Zhen-Guo Wang Combustion, fossil power systems by. 4th ed. 2002 Publisher: McGraw Hill Education.
2. "Internal Combustion Processes of Liquid Rocket Engines: Modeling and Numerical Simulations" 2010 Narosa Publishing House
3. William A Sirignano "Advances in Combustion Science: 173 (Progress in Astronautics and Aeronautics)" 2010

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Familiar with the concepts of air transportation and the maintenance management of aircraft	3	1		3	2	3	1	3			1			1	3
Co2	Apply the chemical kinetics and chemical equilibrium	3	1	2	3	2	2	1	3	3				3	2	
Co3	Describe the concepts of engines and combustion system of engines	3	1	2	3	1	3	1	3				3		1	
Co4	Apply the principles of combustion of rocket engines.	3	1		3	2	3	1	3		2	2	2		3	3
Co5	The students will acquire knowledge about pollution and reduction of pollutants	3	2		3	2	2	1	3	1		1	3		1	

818AEE09	Air Transportation And Aircraft Maintenance	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) The concepts of air transportation.
b) The forecasting of factors affecting the choice of fleet.
c) The principles of airline and crew scheduling.
d) The concepts about EROPS and ETOPS and aircraft reliability.
e) The principles of monitoring and maintenance of aircraft.

UNIT I INTRODUCTION **9 Periods**

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT II AIRLINE ECONOMICS **9 Periods**

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection. Fleet Planning**:** The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation &Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis –Aircraft evaluation.

UNIT III PRINCIPLES OF AIRLINES SCHEDULING **9 Periods**

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipment's and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV AIRCRAFT RELIABILITY **9 Periods**

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT V TECHNOLOGY IN AIRCRAFT MAINTENANCE **9 Periods**

Airlines scheduling (with reference to engineering) – Product support and spares –Maintenance sharing – Equipment's and tools for aircraft maintenance – Aircraft weight control – Budgetary control. On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

Total: 45 periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Familiar with the concepts of air transportation.
b) The student will be able to forecast the factors affecting the choice of fleet.
c) Apply the principles of aircraft and crew scheduling
d) Describe the concepts of EROPS and ETOPS and aircraft reliability.
e) Apply the techniques of aircraft maintenance and monitoring.

TEXT BOOKS

1. Fedric j.h., “airport management”, publishers of children's books Fourth edition, 2011.
2. P S Senguttuvan “Fundamentals Of Air Transport Management”, Ashgate Publishing 2010.

REFERENCES

1. Gene kropf, “airline procedures”, second edition, S Chand Publishing 2009.
2. Alexander t wells, “air transportation”, wads worth publishing company, California, 1993.
3. Dieter Schmitt and Volker Gollnick “Air Transport System Khanna Book Publishing (Research Topics in Aerospace)” 2013

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Familiar with the concepts of air transportation	3	1		3	2	3	1	3	1		2			1	
Co2	The student will be able to forecast the factors affecting the choice of fleet	3	2		3	2	3	1	3		2			2	1	
Co3	Apply the principles of aircraft and crew scheduling	3	1	2	3	2	2	1	3				3		2	
Co4	Describe the concepts of EROPS and ETOPS and aircraft reliability	3	1	1	3	2	3	3	2				3		1	2
Co5	Apply the techniques of aircraft maintenance and monitoring		2		3	2	3	1	3		1	1			1	3

818AEE10	Engineering Optimization	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) The concepts of Optimal Problem formulation
b) The principles of Direct Search methods and Univariate method
c) The concepts of Wolfe's and Beale's methods.
d) The principles of Simplex method and Artificial variable techniques plan
e) The Types of simulation Models

UNIT I INTRODUCTION **9 Periods**

Optimal Problem formulation: Design variables-Constraints- Objective function Variable bounds. Engineering Optimization problems: Classification& Some examples (just theory & discussion): Truss structure. Single variable non-linear optimization problems: Local minimum Global minimum & Inflection point. Necessary & Sufficient conditions theorems, some problems based on this. Numerical methods: Exhaustive Search methods- Fibonacci method, Golden section method & comparison. Interpolation methods: Quadratic

UNIT II MULTIVARIABLE UNCONSTRAINED NON-LINEAR OPTIMIZATION **9 Periods**

Direct Search methods: Univariate method, Pattern Search methods: Powell, Hook-Jeeve's, Rosen Brock's search and Simplex methods. Gradient methods: Gradient of a function-Importance-Gradient direction search based methods: Steepest descent/ascent method, Conjugate gradient method and variable metric method.

UNIT III MULTIVARIABLE CONSTRAINED NON-LINEAR OPTIMIZATION PROBLEMS CLASSICAL OPTIMIZATION TECHNIQUES **9 Periods**

Constraints – equations-Lagrangian method- inequalities-Kuhn-Tucker necessary and sufficient conditions-Quadratic problem-Statement- Wolfe's and Beale's methods.

UNIT IV GEOMETRIC PROGRAMMING **9 Periods**

Polynomials – arithmetic – geometric inequality – unconstrained, Sensitivity Analysis: Linear programming – Formulation – Simplex method and Artificial variable techniques-Big-M & two-phase methods- Change in the cost coefficients, coefficients & constants of the constraints, addition of variables

UNIT V SIMULATION **9 Periods**

Definition-Steps involved- Types of simulation Models-Advantages and disadvantages-Simple problems on queuing & inventory.

Total: 45 periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Familiar with the concepts of Fibonacci method, Golden section method
b) Apply the Rosen Brock's search and Simplex methods.
c) Describe the concepts of -Lagrangian method.
d) Apply the principles of Big-M & two-phase methods
e) The students will acquire knowledge about queuing & inventory

TEXT BOOK

1. S.S.Rao-New Age International Publications Engineering Optimization: Theory & Practice- -Publisher: Wiley Third edition 2003
2. Kalyanmoy" Engineering Optimization "Deb-Prentice-Hall of India Pvt.Ltd, New Delhi- 2005.

REFERENCE BOOKS

1. Beveridge & Schechter. McGraw-Hill Optimization Theory & Practice: International Student edition. 2000.
2. Ronald L.Rardin Optimization in Operations Research. Pearson Education, Low Price Edition 2012.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Familiar with the concepts of Fibonacci method, Golden section method	3	1		3	2	3	1	3	2				2	1	
Co2	Apply the Rosen Brock's search and Simplex methods	3	1		3	1	3	1	3		2	3			2	
Co3	Describe the concepts of -Lagrangian method	3	1		3	2	3	1	3				3		1	3
Co4	Apply the principles of Big-M & two-phase methods	3	1		3	3	3	1	3	1			2		3	
Co5	The students will acquire knowledge about queuing & inventory		2		3	2	3	1	3	1		3			1	

818AEE11	Gas Turbine Technology	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The students will be able to

a) Familiarize the functions of components of gas turbine.
b) Analyze the power cycles for optimum thermal performance.
c) Understand axial flow compressor characteristics.
d) Understand combustion systems and axial flow turbine operation
e) Familiar with the performance predictions.

UNIT I BASICS OF GAS TURBINES **9 Periods**

Open cycle single shaft and twin shaft multi speed arrangement, closed cycle gas turbine operation, Aircraft propulsion, and Industrial applications of gas turbines, Environmental issues and future enhancement possibilities

UNIT II POWER CYCLES **9 Periods**

Ideal cycles method of accounting component losses , Design point performance calculations , Comparative performance of practical cycles - Combined cycle -Cognation schemes ,Closed cycle gas turbine with reheat, inter-cooling and regenerator, problems.

UNIT III AXIAL FLOW COMPRESSORS **9 Periods**

Axial flow compressor basic operation: Elementary theory, factors effecting stage pressure ratio , Blockage in compressor annulus - Degree of reaction - Blade fixing details - Sealing materials and material selection for compressor blades , Stage performance - Design and off design performance characteristics, problems

UNIT IV COMBUSTION SYSTEMS AND TURBINES **9 Periods**

Types of combustion and combustion requirements, Factors affecting combustion process , Combustion chamber heat calculations, Turbine construction, performance, impeller blade fixing. Cooling of turbine blades, blade vibration and protective coating, Gas turbine turbo chargers and power expanders, vortex theory Estimation of stage performance.

UNIT V PERFORMANCE PREDICTIONS **9 Periods**

Prediction performance of gas turbines component characteristics Of design operation - Equilibrium running of gas generator Methods of displacing of the equilibrium running line, Incorporation of variable pressure losses Matching procedure for two spool engines, principle of control system

Total: 45 periods

COURSE OUTCOMES

On successful completion of this course, student should be able to

a) Explain the Airworthiness requirements for different categories of aircrafts.
b) Discuss the various certifications, technical log book.
c) Explain the procedure for development, test flight and certification.
d) Discuss the accident investigation procedures.
e) Familiar with the performance predictions.

TEXT BOOKS

1. Mattingly.j.d, “elements of propulsion: gas turbines and rockets”, mcgraw hill, 2012 reference books/other reading material
2. Horlock.J.H, “Advanced Gas Turbine Cycles”, Elsevier Science Ltd, 2003.

REFERENCE BOOKS

1. Ganesan.V, “Gas Turbines”, Tata McGraw Hill, 3rd Edition, 2010.
2. Yahya S.M, “Turbines, Fans and Compressors”, 3rd Edition, Tata McGraw Hill Publications, 2010.
3. Gopalakrishnan.G, Prithvi Raj D, “Treatise on Turbomachines”, 1st Edition, Chennai, SciTech Publications, 2006.

Course Outcome		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	Explain the Airworthiness requirements for different categories of aircrafts	3	1		3	2	3	1	3			2			1	
Co2	Discuss the various certifications, technical log book	3	1		3	2	3	1	3	2			3	2	1	3
Co3	Explain the procedure for development, test flight and certification	3	1	2	3	2	3	1	2				3		2	
Co4	Discuss the accident investigation procedures	3	1		3	2	3	1	3						1	3
Co5	Familiar with the performance predictions	3	2		3	2	3	1	3		3	1			1	