ME16101 **ENGINEERING GRAPHICS** **3 2 0 4**

(COMMON TO MECH / AGRI / CIVIL / MCT / ECE)

COURSE OBJECTIVES

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections

Concepts and Conventions (Not for Examination) **2**

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 14

Curves Used In Engineering Practices:

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid and Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves. Construction of spiral curve.

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 14

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

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14

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

surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 14

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

INTRODUCTION TO INTERSECTION OF SOLIDS (Not for Examination**) 5**

Introduction to intersection of surfaces – Line of intersection – Intersection of solids

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- perform free hand sketching of basic geometrical constructions and multiple views of objects
- draw the projections of points, straight lines and plane surfaces in given quadrant
- understand the projection of solids in various positions in first quadrant
- draw projections and solids and development of surfaces
- prepare isometric and perspective sections of simple solids

TEXT BOOKS

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. S.Prabhakaran, M.Makesh, V. Subburam, “Engineering Graphics”, Sams Publishers, Chennai, 2015.

REFERENCES

1. Gopalakrishnan K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

WEBLINKS

1. http://www.nptel.ac.in/courses/112103019
2. http://www.engineeringdrawing.org/
3. http://www.mechanical.in/engineering-graphics/

PUBLICATION OF BUREAU OF INDIAN STANDARDS

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO2	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO3	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO4	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO5	3	3	3	3	3	1	-	-	-	-	1	1	2	1

EN16202 ENGLISH COMMUNICATION SKILLS LABORATORY 0 0 2 1

COURSE OBJECTIVES:

To enable the students to

- Instill the basic communication concepts to enhance students' communication skills through various lab sessions.
- Help students develop the ability to communicate effectively in spoken English.
- Help students develop their soft skills and interpersonal skills.
- Increase employability by developing students' communication skills in English.

UNIT I FORMAL & INFORMAL CONVERSATION PRACTICE 9

Role Play conversations - with family members, neighbors, friends, relatives etc. Simple expressions - agreeing/disagreeing, persuading, wishing,consoling,advising,arguing,expressingopinionsetc.-Professional dialogues with superiors - Conversation with different professionals in - Government and Corporate Offices, Official Meetings, Educational Institutions, (At the railway junction, malls, post office,bank) etc-every day usage of English

UNIT II ORAL REVIEW, RADIO SHOW & NARRATIVE TECHNIQUES 9

Oral review of books - Presentation of various radio programs like news, announcements, advertisements, entertainment programs etc. as a team activity. Understanding the basic narrative techniques – Narrating short stories, Narrating real life experiences, Oral interpretation of charts, tables, graphs.

UNIT III RESUME / LETTER WRITING 9

Preparation of resume- structure – Types of resume – writing the vision statement – Objectives – Types ofLetter –Job Application–accepting/declining a Job offer.

UNIT IV PRESENTATION SKILLS & GROUP DISCUSSION 9

Elements of effective presentation – Structure of a presentation – Speech acts - effective use to presentation tools - Audience analysis – Preparing the PPT slides - Video samples- Importance ofGD –in the selection process - Structure of a GD – Moderator – led and other GDs - Strategies in GD – Team work – Body Language-Mock GD-Video samples

UNIT VI NTERVIEW SKILLS

Kinds of interviews–one to one, group interview, telephone interview, online interview, stress interview-Required Skills– Corporate culture–Mock interviews-Video samples.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- listen and comprehend classroom lectures, short talks and conversations.
- read, interpret and analyze a given text effectively, and use cohesive devices in spoken and written English.
- understand English and converse effectively.
- write flawless sentences, Job application.

TEXT BOOKS:

- Kalpana.V&Co.,"Communication Skills Laboratory Manual", Vijay Nicole Imprints Pvt. Limited, Chennai.2013
- Rizvi,Ashraf. M.Effective Technical Communication.TataMcGraw-Hill, NewDelhi.2005.

REFERENCE BOOKS:

- Anderson,P.V."Technical Communication",Thomson Edition,NewDelhi,2007.
- Kumar Sanjay, PushpLata,"Communication Skills (With CD)",Oxford University Press, NewDelhi.2011

	Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
COs	**Programmes Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	2	3	3	1	-	-
CO2	-	-	-	2	3	-	1	2	-	3	3	1	-	-
CO3	-	-	-	-	-	-	-	-	-	3	1	1	-	-
CO4	-	-	-	-	3	1	1	-	2	3	3	1	-	-

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B.E.AERONAUTICAL ENGINEERING

REGULATION 2016

CURRICULUM

(CHOICE BASED CREDIT SYSTEM)

SEMESTER III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	BS	MA16301	Transforms And Boundary Value Problems	3	2	0	4
2.	PC	AE16301	Aircraft Materials and Manufacturing Technology	3	0	0	3
3.	PC	AE16302	Basics of Aeronautical Engineering	3	0	0	3
4.	ES	AE16303	Fluid Mechanics and Machinery	3	0	0	3
5.	ES	AE16304	Solid Mechanics	3	0	0	3
6.	ES	AE16305	Thermodynamics and Heat Transfer	3	0	0	3
Practical							
7.	ES	AE16306	Fluid Mechanics and Machinery Laboratory	0	0	4	2
8.	ES	AE16307	Strength of Materials Laboratory	0	0	4	2
9.	ES	AE16308	Thermodynamics Laboratory	0	0	4	2
			TOTAL	**18**	**2**	**12**	**25**

SEMESTER IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	BS	MA16404	Numerical Methods	3	2	0	4
2.	PC	AE16401	Aerodynamics	3	0	0	3
3.	PC	AE16402	Aircraft Propulsion	3	0	0	3
4.	PC	AE16403	Aircraft Structures I	3	2	0	4
5.	PC	AE16404	Aircraft Systems and Instrumentations	3	0	0	3
6.	BS	CH16403	Environmental Science and Engineering	3	0	0	3
Practical							
7.	PC	AE16405	Aerodynamics Laboratory	0	0	4	2
8.	PC	AE16406	Aircraft Structures Laboratory I	0	0	4	2
9.	HS	EN16401	Business English Course Laboratory	0	0	2	1
			TOTAL	**18**	**4**	**10**	**25**

AE16301 AIRCRAFT MATERIALS AND MANUFACTURING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study about the various metal casting and welding process followed in industries
- introduce the various metallic and non-metallic engineering materials used in aircraft applications and their test methods.
- understand the effect of corrosion in the aircraft materials and its prevention methods.
- learn the heat treatment process of ferrous and non-ferrous materials.
- know the basic concepts of composite materials and its applications.

UNIT I CASTING 8

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING 8

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

UNIT III MACHINING 10

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

UNIT IV AIRCRAFT METAL ALLOYS AND SUPERALLOYS 10

Aluminum alloys, Magnesium alloys, Titanium alloys, Plain carbon and Low carbon Steels, Corrosion and Heat resistant steels, Maraging steels, Copper alloys, Producibility and Surface treatments for each of the above – Super alloys, Nickel based super alloys, Cobalt based super alloys, and Iron based super alloys, manufacturing processes associated with super alloys, Heat treatment and surface treatment of super alloys.

UNIT V AIRCRAFT COMPOSITE MATERIALS AND NON METALLIC 9

Composite materials – GFRP, CFRP, MMC, GLARE – Classification and properties of wood, plywood and applications – Ablation process-ablative materials- super conducting materials matrix materials- their applications – Purpose of Doping – Adhesives – Aircraft paints – Rubber and Rubber materials.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- demonstrate about different manufacturing process and applications in industry for component production
- analyze the properties of different aircraft materials.
- compare the properties of various alloys for aerospace application.

- conduct the heat treatment and surface treatment process for various alloys.
- identify the suitable materials for different parts of the aircraft.

TEXT BOOKS

1. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007
2. Hajra Choudhury, "Elements of Workshop Technology", Vol. I, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2010.

REFERENCES

1. Krishnadas Nair C G, „Handbook of Aircraft Materials", First Edition, Interline Publishers, Bangalore, 1993.
2. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.
3. Horst Buhl (Ed.), „Advanced Aerospace Materials", Springer-Verlag, 1992.
4. George Francis Titterton, „Aircraft Material and Processes", Fifth Edition, Sterling Book House, Mumbai, 1998
5. Hajra Choudhury, "Elements of Workshop Technology", Vol. II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2010.

WEB LINKS

1. http://www.nptelvideos.in/2012/12/advanced-materials-and-processes.html
2. http://nptel.ac.in/courses/112107144/

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	3	3	2	-	3	-	-	-	-	2	3	3
CO2	-	2	2	3	3	-	2	-	-	-	-	2	3	2
CO3	-	2	3	3	2	-	2	-	-	-	-	2	2	3
CO4	-	3	2	2	3	-	3	-	-	-	-	2	2	2
CO5	-	3	3	2	3	-	3	-	-	-	-	2	3	2

AE16303 FLUID MECHANICS AND MACHINERY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study about the basic fluid properties and flow characteristics
- apply the conservation laws to flow through pipes and hydraulic machines
- know the importance of dimensional analysis.
- study about the various types of pumps and its applications.
- understand the importance of various types of flow in turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 6

Units and dimensions-Properties of fluids. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

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

UNIT III DIMENSIONAL ANALYSIS 10

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

UNIT IV PUMPS 10

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

UNIT V TURBINES 10

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply mathematical knowledge to predict the properties and characteristics of a fluid.
- perform the flow analysis in circular pipes
- identify about the concepts involved in dimensional analysis
- analyze the performance of pumps and its industrial applications.
- execute the performance calculations of turbines.

TEXT BOOKS

1. White F, Fluid „Mechanics",5th Edition, Tata McGraw-Hill, , New Delhi, 2011.
2. Nodi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2009.

REFERENCES

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2010
3. Philip J. Pritchard, „Fox and McDonald"s Introduction to Fluid Mechanics", Eighth Edition, Wiley, 2011.
4. Yunus A. Cengel and John M. Cimbala, „Fluid Mechanics: Fundamentals and Applications", Third Edition,McGraw-Hill, 2013.
5. R. K. Bansal, „Fluid Mechanics", Laxmi Publications (P) Ltd, 2008.

WEB LINKS

1. http://www.nptelvideos.in/2012/11/fluid-mechanics.html
2. http://nptel.ac.in/courses/112105182/#

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	3	2	-	-	-	-	-	-	2	3	2
CO2	1	3	2	2	3	-	-	-	-	-	-	2	3	2
CO3	2	2	3	3	2	3	-	-	-	-	-	2	2	2
CO4	3	2	2	2	2	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	3	-	-	-	-	3	2	3	2

AE16304 **SOLID MECHANICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- study the behavior of materials due to axial, bending, tensional and combined loads.
- infer the knowledge of Stresses in various beams of mechanical, civil and aeronautical engineering
- study about the bending of beams with its various methods.
- know the application of torsion for various material sections.
- understand the basic concepts of bi axial Stresses with pressure for different sections.

UNIT I BASICS AND AXIAL LOADING **9**

Stress and Strain – Hooke"s Law – Elastic constants and their relationship – Volumetric strain. Bar with uniform and varying section – composite bar. Thermal Stresses – stresses due to freely falling weight.

UNIT II STRESSES IN BEAMS **9**

Shear force and bending moment diagrams for simply supported and cantilever beams with concentrated load and uniformly distributed – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength.

UNIT III DEFLECTION OF BEAMS **9**

Double integration method – McCauley"s method – Area moment method – Conjugate beam method.

UNIT IV TORSION **9**

Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.

UNIT V BI AXIAL STRESSES **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand principles of mathematics, basic sciences and engineering.
- analyze the stress and bending of beams in structures
- apply knowledge of science and engineering principles to solve aeronautical engineering problems.
- perform the torsion analysis process of beam sections
- acquire knowledge about the Bi Axial stress in structures

TEXT BOOKS

1. Stephen Timoshenko, James M. Gere "Mechanics of materials" Van Nostrand Reinhold Co., 1972.
2. Rajput R.K "Strength of Materials"S.Chand and Company Ltd,2012

REFERENCES

1. Stephen Timoshenko and D. H.Young, Elements of strength Materials, Vol. I and Vol. II, T. Van No Strand Co-Inc Princeton- N.J
2. Dym C L and I. H. Shames, „Solid Mechanics", 2013.
3. Nash William, „Strength of Materials", TMH, 2010.
4. Timoshenko.S, „Strength of Materials", Vol. II, CBS Publishers, 2002.
5. Srinath L.S., „Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

WEB LINKS

1. http://www.nptelvideos.in/2012/11/mechanics-of-solids.html
2. http://web.mit.edu/emech/dontindex

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	-	-	-	-	-	-	3	2	3	2
CO2	2	3	1	2	-	-	-	-	-	-	2	2	3	2
CO3	2	3	2	3	-	-	-	-	-	-	3	2	2	2
CO4	2	3	2	3	-	-	-	-	-	-	2	2	3	2
CO5	3	2	2	2	-	-	-	-	-	-	2	2	3	2

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AE16305 THERMODYNAMICS AND HEAT TRANSFER 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the principles and basics of thermodynamics.
- study about the various air cycles and its applications.
- provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, properties of pure substances.
- infer the concept of air-conditioning and its concepts
- enlighten the basic concepts of heat transfer and propulsion cycles.

UNIT I BASIC THERMODYNAMICS 9

Systems – Zeroth Law, First Law – Heat and work transfer in flow and non-flow processes – Difference in heat capacities, Ratio of specific heats – Second law, Kelvin Planck statement – Clausius statement – Concept of entropy – Entropy change in non-flow processes – T-S equations for entropy change – Numerical Problems.

UNIT II AIR CYCLES 9

Air standard cycle approximations – Otto, Diesel Cycles – P-v and T-s diagrams –Description – Efficiency, Mean Effective Pressure – Comparison of Otto, Diesel cycles for same compression ratio and heat input – Dual cycles – P-v and T-s diagrams – Brayton cycle for open and closed systems – Efficiency of gas turbine cycle – Numerical problems.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 9

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 AIR CONDITIONING 9

Principles of refrigeration, Air conditioning – Vapour compression – Vapour absorption types –Air cycle machine – Humidity control – Coefficient of performance – Properties of refrigerants

UNIT V BASICS OF HEAT TRANSFER 9

Types of heat transfer-free convection-forced convection- specific impulse – ideal and non- ideal cycle analysis - conduction in parallel, radial and composite wall.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply thermodynamic laws to solve the complex engineering problems.
- explain the principles of continuity, momentum and energy equation to solve the problems in simple jet propulsion systems.
- determine the efficiency and net work of the otto, diesel, and brayton cycles, and to make connections between these cycles and aircraft propulsion systems.
- calculate the design parameters for various air conditioning components.
- apply the basic concepts of heat transfer to solve the various engineering problems

TEXT BOOKS

1. Nag P K, „Engineering Thermodynamics", Fifth Edition, Tata McGraw-Hill, 2013.
2. Rathakrishnan, E, „Fundamentals of Engineering Thermodynamics", Prentice Hall, 2005.

REFERENCES

1. Gordon J. Van Wylen and Richard E. Sonntag, „Fundamentals of Classical Thermodynamics", Sixth Edition, Wiley Publication, 2003.
2. Yunus A. Çengel and Michael A. Boles, „Thermodynamics an Engineering Approach", Seventh Edition, Tata McGraw-Hill, 2010.
3. Oates, G.C., „Aero Thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
4. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
5. Prasanna Kumar: Thermodynamics "Engineering Thermodynamics" Pearson Education, 2013

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/Basic_Thermodynamics/ui/TOC.htm
2. http://nptel.ac.in/courses/112105123/1

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	-	-	-	-	-	-	2	3	2
CO2	2	3	1	3	3	-	-	-	-	-	-	2	3	2
CO3	-	3	2	2	2	2	3	-	-	-	-	2	2	2
CO4	3	2	2	3	2	3	2	-	-	-	-	2	3	2
CO5	2	3	2	3	3	2	2	-	-	-	-	2	3	2

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AE16306 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- study and experiment the flow measurement and the performance of the various fluid machinery
- familiarize the basic flow on the turbines
- impart the knowledge of pumps
- learn about the viscosity

LIST OF EXPERIMENTS

1. Calibration of venturimeter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Performance test on piston wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

TOTAL PERIODS 60

COURSE OUTCOMES

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

- gain the knowledge measurement equipments for flow measurement
- perform the flow visualization of various apparatus
- analyze the performance thrust on different fluid machinery pumps
- analyze the problems in turbine

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	3	-	-	-	-	-	-	2	3	2
CO2	1	3	3	2	2	-	-	-	-	-	-	2	3	2
CO3	3	2	2	3	3	2	-	-	-	-	-	2	2	2
CO4	3	2	3	3	2	2	-	-	-	-	3	2	3	2

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AE16307 **STRENGTH OF MATERIALS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- impart the knowledge in testing the materials for hardness, fatigue, impact, tension and torsion.
- familiarize the hardness of materials
- impart the knowledge of strength of materials
- learn about the Fatigue

LIST OF EXPERIMENTS

1. Determine the BHN using Brinell Hardness Test
2. Determine the RHN using Rockwell Hardness test
3. Determine the Tension of various Materials using Tension test
4. Determine the Torsion of Various Materials using Torsion test
5. Determine the Impact Strength value by using Izod Impact test
6. Determine the Impact Strength value by using Charpy Impact test
7. Perform the Reverse plate bending Fatigue test
8. Perform the Rotating Beam Fatigue test
9. Testing of springs
10. Perform the Block Compression Test for various Materials

TOTAL PERIODS 60

COURSE OUTCOMES

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

- perform different destructive testing
- gain knowledge of torsion, Fatigue and Tension
- characterize materials by its strength values
- perform compression test of various materials and springs

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	-	-	-	-	-	-	-	2	3	2
CO2	2	3	3	2	-	-	-	-	-	-	-	2	3	2
CO3	2	3	2	3	-	-	-	-	-	-	-	2	2	2
CO4	2	3	2	3	-	-	-	-	-	-	-	2	3	2

AE16308 **THERMODYNAMICS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- enhance and experiment the basic knowledge in applied thermodynamics and engines
- familiarize the flow of heat exchanger
- impart the knowledge of air-condition
- learn about the thermal conductivity

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 PERIODS 60

COURSE OUTCOMES

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

- perform test on diesel/petrol engine
- explain the characteristics of the diesel/petrol engine
- compute the properties of the fuels.
- calculate performance coefficients of vapour compression systems

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	2	3	2	-	-	2	2	-	2	3	2
CO2	2	3	2	3	-	3	-	-	1	-	2	2	3	2
CO3	2	3	-	3	-	2	3	-	3	-	3	2	2	2
CO4	3	-	1	-	2	2	2	-	2	-	3	2	3	2

AE16401 **AERODYNAMICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce the concepts of mass, momentum and energy conservation relating to aerodynamics.
- make the student to understand the concept of vorticity, irrotationality, theory of airfoils and wing sections.
- study the conformal transformation process.
- introduce the basics of airfoil wing theory and its applications.
- learn the boundary layer theory and its problems

UNIT I INTRODUCTION TO AERODYNAMICS **9**

Aerodynamic forces and moments – Pressure distribution on an airfoil – Types of drag – Continuity, momentum and energy equations – Incompressible-inviscid flow – Irrotational flow – Circulation and Vorticity – Euler"s equation – Bernoulli"s Equation – Pitot tube: Measurement of airspeed, Pressure Coefficient.

UNIT II TWO DIMENSIONAL FLOWS **9**

Elementary flows – Uniform, Source, Sink, Doublet and vortex flow, Combination of a uniform flow with a source and sink, Non lifting flow over a circular cylinder, Lifting flow over a cylinder, Kutta Joukowski theorem and Generation of lift, D"Alembert Paradox, Magnus effect-Numerical Problemes

UNIT III CONFORMAL TRANSFORMATION **8**

Joukowski transformation and its application to fluid flow problems, Joukowski, and Karman-Trefftz Profiles-Numerical Problems.

UNIT IV AIRFOIL AND WING THEORY **10**

Airfoil Nomenclature – Airfoil characteristics, NACA airfoils and Modern airfoils – Kutta condition – Thin airfoil theory and its applications – Aerodynamic Center – Horse shoe vortex, Vortex filament – Biot and Savart law – Downwash and induced drag – Helmholtz theorems, Lifting line theory and its limitations.

UNIT V INTRODUCTION TO BOUNDARY LAYER THEORY **9**

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, shape parameter, boundary layer equations for a steady, two dimensional incompressible flow, boundary layer growth over a flat plate, critical Reynolds number, Blasius solution, basics of turbulent flow

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply airfoil theory to predict airfoil performance and behavior of airflow over bodies
- analyze and optimize the aircraft wing performance.
- perform the dimensional analysis in two dimensions
- analyze the problems of incompressible flow for airfoils
- explain the properties of boundary layer

TEXT BOOKS

1. Anderson, J.D., „Fundamentals of Aerodynamics", Fifth Edition, McGraw-Hill Book Co., New York, 2012.
2. Houghton E L, P. W. Carpenter, Steven H. Collicott, and Daniel T. Valentine, „Aerodynamics for Engineering Students", Sixth Edition, Butterworth-Heinemann, 2012.

REFERENCES

1. Clancy, L.J., „Aerodynamics", Pitman, 1986.
2. Kuethe A M and C-Y Chow, „Foundations of Aerodynamics: Bases of Aerodynamic Design", Fifth Edition, Wiley, 1997.
3. John J. Bertin and Russell M. Cummings, „Aerodynamics for Engineers", Sixth Edition, Pearson, 2013.

WEB LINKS

1. http://nptel.ac.in/courses/101105059/
2. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	-	-	-	-	-	-	2	3	2
CO2	2	3	1	3	2	-	2	-	-	-	-	2	3	2
CO3	2	3	2	2	3	2	-	-	-	-	-	2	2	2
CO4	-	2	2	3	2	2	-	-	-	-	-	2	3	2
CO5	2	3	2	3	3	3	2	-	-	-	-	2	3	2

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AE16402 **AIRCRAFT PROPULSION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce basic concepts and salient features of engine components of jet propelled engines which are operated in atmosphere to students.
- familiarize with jet propulsion components and its methods.
- understand the performance and types of combustion chambers and nozzles.
- study about the details of compressor of jet propulsion and hypersonic propulsion
- infer about the working of turbines and its applications

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES **9**

Classification of gas turbines – open cycle and closed cycle turbines, efficiencies - 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 INLETS FOR JET ENGINES **9**

Internal flow and Stall in subsonic inlets – relation between minimum area ratio and eternal deceleration ratio – diffuser performance – supersonic inlets – starting problem on supersonic inlets – shock swallowing by area. variation – Numerical problems

UNIT III COMBUSTION CHAMBERS AND NOZZLES **10**

Classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization real flow in nozzles and nozzle efficiency – losses in nozzles – equilibrium flow and frozen flow in nozzles- two phase flow in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal- Numerical Problems

UNIT IV COMPRESSORS FOR JET ENGINES **8**

Principle of operation of centrifugal compressor and axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance characteristics of centrifugal and axial flow compressors

UNIT V TURBINES FOR JET ENGINES **9**

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.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the engine components of jet propelled engines analyze thermodynamics of an aircraft jet engine
- estimate the best possible engine performance
- assess the internal mechanisms of gas turbine engine components
- evaluate the operating characteristics of compressors and Turbines
- examine the working of turbine

TEXT BOOKS

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 2009.
2. James Award, "Aerospace Propulsion System", wiley,2010

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 2006.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, NewYork,1985
3. Rolls Royce, "Jet Engine", 5th Edition, Rolls Royce Technical Publications, 2015.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2010.
5. Ganesan.V, „Gas Turbines", Third Edition, Tata McGraw-Hill, 2010.

WEB LINKS

1. http://nptel.ac.in/courses/101101001/
2. http://www.nptelvideos.in/2012/11/jet-aircraft-propulsion.html

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	2	3	-	-	-	2	2	3	2
CO2	-	3	1	2	2	1	-	-	-	-	3	2	3	2
CO3	-	3	2	2	3	3	-	-	-	-	3	3	2	2
CO4	-	2	2	3	2	3	2	-	2	-	3	2	3	2
CO5	-	3	2	3	3	3	2	-	2	-	2	2	3	2

AE16403 **AIRCRAFT STRUCTURES I** **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- provide the students an understanding on the aircraft basic structures
- infer about the indeterminate and determinate aircraft structural components.
- learn about various energy methods and its applications
- study about the column and loading functions
- offer the design process using different failure theories

UNIT I INTRODUCTION TO AIRCRAFT STRUCTURES **15**

Aircraft construction methods – Components of Semi-monocoque structure – Component loads – Stress types - Stress-strain relation – Strain-displacement relations – Equations of equilibrium – Strain tensor – Lame"s constant - cubical dilation

UNIT II STATICALLY DETERMINATE AND INDETERMINATE STRUCTURE **15**

Truss analysis – Method of joints – Method of sections – Clapeyron"s three moment equation – Moment distribution method.

UNIT III ENERGY METHODS **15**

Strain energy due to axial, bending and torsional loads – Castigliano"s theorem – Maxwell"s reciprocal theorem, unit load method – Application to beams, trusses, frames, rings, etc.

UNIT IV COLUMNS **15**

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 **15**

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

TOTAL PERIODS 75

COURSE OUTCOMES

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

- understand different aircraft structures.
- calculate the response of statically indeterminate structures under various loading conditions.
- apply the reaction forces of structures using strain energy concept.
- create a structure to carry the given load.
- examine the structural failures using failure theories

TEXT BOOKS

1. Donaldson B.K, "Analysis of Aircraft Structures – An Introduction", 2nd Edition, Cambridge University Press.
2. Megson T.H.G, "Aircraft Structures for Engineering Students" 4th Edition, Elsevier AerospaceEngineering Series, 2007.

REFERENCES

1. Prof S K Maiti, "Advanced Strength of Materials", NPTEL, Web course, Department of Mechanical Engineering, Indian Institute of Technology, Bombay
2. John Cutler, Jeremy liber, "Understanding Aircraft Structures", 4th Edition, Wiley Balckwell publishing.
3. Lakshmi Narasaiah.G,"Aircraft Structures", BSP Books Pvt.Ltd-Hyderabad.
4. Peery D.J,"Aircraft Structures", 2nd Edition, McGraw Hill.

WEB LINKS

1. http://www.nptelvideos.in/2012/11/structural-analysis-ii.html
2. http://www.nptel.ac.in/courses/112107146/34

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	3	-	-	-	3	2	3	2
CO2	2	3	2	3	2	-	2	-	-	-	3	3	3	2
CO3	2	3	2	2	3	-	3	-	-	-	3	2	2	2
CO4	3	2	2	3	2	-	3	-	-	-	2	2	3	2
CO5	2	3	2	1	3	3	2	-	-	-	3	2	3	2

AE16404 AIRCRAFT SYSTEMS AND INSTRUMENTATIONS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the knowledge of hydraulic and pneumatic systems components.
- study the engines and its various control systems
- gain knowledge of advance control systems and its applications
- learn about the types of instruments and its operation including navigational instruments
- understand about the cockpit layout of a aircraft

UNIT I CONVENTIONAL AIRCRAFT SYSTEMS 9

Conventional flight control system – Hydraulic and Pneumatic systems – Electrical Power generation and distribution system – Environmental control system – De-icing and anti-icing systems – Landing gear system – Aircraft fuel systems.

UNIT II CONVENTIONAL ENGINE CONTROL SYSTEMS 9

Fuel systems of Piston engine and Jet engine – Main engine components and functions of jet engines – Engine lubrication systems – Accessory gear box and accessories driven – Engine starting system – Main and After burner fuel control systems – Thrust reversing and Thrust vector control.

UNIT III ADVANCED TECHNOLOGY SYSTEMS 9

Autopilot system – Advanced flight control systems – Flight Management System – Communication and Navigation systems – Radar and weapon control systems – Full Authority Digital Engine Control (FADEC) system.

UNIT IV AIRCRAFT INSTRUMENTS 9

Flight instruments, Navigation and Communication instruments, Gyroscope, Accelerometers, Airspeed indicator, Mach meter, Electronic horizontal situation indicator, Horizontal situation indicator, Multi Function Display, Attitude director indicator, Primary Flight Display, Engine instruments and display – Operation and principles, Flight Data Recorder (FDR), Cockpit Voice Recorder (CVR).

UNIT V COCKPIT LAYOUT 9

Ergonomic layout – Controls and Indications – Display systems – Self test and Built-In Test Equipment (BITE) – Cockpit air-conditioning and pressurization – Challenges posed by cockpit to the designer – Failure warning system.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare the features of various flight control systems.
- describe the principle and working of different aircraft systems.
- analyze the performance of various aircraft engine systems.
- acquire and interpret data from various aircraft instruments.
- identify the various cockpit controls.

TEXT BOOKS

1. Pallett E H J, „Aircraft Instruments – Principles and Applications", Second Edition, Longman House, 1981.
2. Pallett E H J and S. Coyle, „Automatic Flight Control", Fourth Edition, Blackwell Science Ltd, 1993.
3. Irwin Treager, „Aircraft Gas Turbine Engine Technology", Third Edition, McGraw- Hill, 2013.

REFERENCES

1. James Powell, „Aircraft Radio Systems", Shroff Publishers, 2006.
2. Ian Moir and Allan Seabridge, „Aircraft Systems – Mechanical, electrical and avionics subsystems integration",Second Edition, Professional Engineering Publishing Limited, 2001.
3. Ian Moir, Allan Seabridge and Malcolm Jukes, „Civil Avionics Systems", Second Edition, Wiley, 2013.
4. "General Hand Book of Airframe and Powerplant Mechanics", U.S.Dept. of Transportation, Federal Aviation Administration, English Book Store, New Delhi, 1995.
5. Mike Tooly and David Wyatt, „Aircraft Communications and Navigation Systems: Principles, Maintenance and Operation",Butterworth-Heinemann"s Series, 2007.

WEB LINKS

1. http://www.faa.gov/regulations_policies
2. http://www.niuniv.com

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	3	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	2	-	-	-	-	-	2	3	2
CO3	3	1	2	2	3	2	-	-	-	-	-	2	2	2
CO4	2	2	3	2	2	2	-	-	-	-	-	2	3	2
CO5	2	2	2	2	3	3	-	-	-	-	-	2	3	2

AE16405 **AERODYNAMICS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- familiarize the students in basic aerodynamics and use of wind tunnels.
- familiarize the calibration of wind tunnel
- impart the knowledge of wind tunnel balance
- learn about the different airfoil lift and drag

LIST OF EXPERIMENTS

1. Flow visualization in water flow channel
2. Flow visualization in smoke tunnel
3. Plot of RPM VS test section velocity in a subsonic wind tunnel.
4. Pressure distribution over circular cylinder.
5. Pressure distribution over airfoil and estimation of C_L and C_D.
6. Force measurement using wind tunnel balance.
7. Determination of lift and drag for the given airfoil section
8. Pressure distribution over a smooth and rough circular cylinder.
9. Pressure distribution over a symmetric and cambered aerofoil.
10. Flow visualization studies in subsonic flows
11. Surface and Flow Pattern Visualization

TOTAL PERIODS 60

COURSE OUTCOMES

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

- operate the wind tunnel for various models
- gain knowledge of lift , drag and pressure relation
- analyze the pressure distribution around various models
- measure pressure distribution over different surfaces.

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	2	2	-	2	3	2
CO2	-	3	2	-	2	3	3	-	2	-	2	2	3	2
CO3	-	-	-	3	3	3	3	-	3	3	-	2	2	2
CO4	1	3	-	-	2	-	-	-	-	3	-	2	3	2

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AE16406 **AIRCRAFT STRUCTURES LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- experiment the load deflection characteristics of structural materials under different types of loads.
- familiarize with reciprocal theorem
- acquaint with mechanical properties of thin cylinder internal pressure
- practically understand the principle of superposition

LIST OF EXPERIMENTS

1. Determination of Young"s modulus of a material.
2. Determination of deflection of a simply supported beam.
3. Determination of deflection of a cantilever beam.
4. Determination of forces in statically indeterminate force system.
5. Verification of Principle of superposition
6. Verification of Maxwell"s Reciprocal theorem
7. Column – Testing using various materials
8. South – well"s plot.
9. Testing of Riveted Joints.
10. Determination of membrane stresses in a thin cylinder under internal pressure.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- know the strength of rivet and thin cylinder
- find the properties of different materials
- gain knowledge of stress variation in the deflected materials
- analyze the strengths of different structures and joints

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	2	-	-	-	2	-	2	-	3	2
CO2	2	3	2	-	3	-	3	-	3	-	3	-	3	2
CO3	2	3	3	-	2	-	-	-	3	-	3	-	2	2
CO4	2	3	3	-	2	-	3	-	2	-	3	-	3	2

EN16401 **BUSINESS ENGLISH COURSE LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- develop the reading skills of the students and make them familiarized in skimming and scanning.
- instill the communication concepts to enhance the students' conversational skills through various practice sessions.
- familiarize them with a variety of business correspondence.
- inculcate the receptive skills i.e. Listening and Reading and to make the students well versed in the Productive skills.

UNIT I READING &VOCABULARY

Understanding short, real notices, messages - detailed comprehension of factual material- skimming & scanning skills - interpreting visual information - reading for detailed factual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information transfer.

UNIT II WRITING

Re-arranging appointments - asking for permission - giving instructions - apologizing and offering compensation - making or altering reservations - dealing with requests - giving information about aproduct.

UNIT III LISTENING

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific information - Listening to conversation- interview, discussion.

UNIT IV SPEAKING

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organizing a larger unit of discourse - giving informationand expressing opinions - two way conversation between candidates followed by further prompting from the interlocutor- Expressing opinions- agreeing and disagreeing.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- enrich the vocabulary through reading and to develop their pronunciation skills.
- prepare flawless reports and proposals.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topic and appear with confidence for on-line tests.

TEXT BOOKS

1. Cambridge BEC Preliminary, Self-Study Edition, Cambridge University Press, New York, 2012.
2. Whitby, Norman. Business Benchmark, Pre-intermediate to intermediate, Business Preliminary, ShreeMaitrey Printech Pvt. Ltd., Noida,2014.

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	3	1	-	-	1	-	3	1	-	-	-
CO2	-	-	-	1	-	-	1	-		3	-	-	-	-
CO3	-	-	-	-	2	-	-	-		2	2	-	-	-
CO4	-	-	-	-	-	1	2	2	3	3	3	-	-	-

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B.E. AERONAUTICAL ENGINEERING

CURRICULUM

REGULATION 2015

SEMESTER V

Course Code	Course Title	L	T	P	C
AE15501	Aerodynamics II	3	0	0	3
AE15502	Aircraft General Engineering and Maintenance Practices	3	0	0	3
E15503	Aircraft Structures II	3	2	0	4
AE15504	Flight Dynamics	3	0	0	3
AE15505	Rocket Propulsion	3	0	0	3
AE15506	Experimental Stress Analysis	3	0	0	3
AE15507	Aircraft Structures II Laboratory	0	0	2	1
AE15508	Propulsion laboratory	0	0	2	1
EN15501	Career Development Laboratory I	0	0	2	1

SEMESTER VI

Course Code	Course Title	L	T	P	C
AE15601	Composite Materials and Structures	3	0	0	3
AE15602	Air Traffic Control and planning	3	0	0	3
AE15603	Finite Element Method	3	2	0	4
AE1515*	Elective I	3	0	0	3
AE1525*	Elective II	3	0	0	3
BA15254	Principles of Management	3	0	0	3
AE15604	Aero CAD Laboratory	0	0	2	1
AE15605	Aircraft Engine and Structures Repair Laboratory	0	0	4	2
EN15601	Career Development Laboratory II	0	0	2	1

SEMESTER VI

ELECTIVE I

Course Code	Course Title	L	T	P	C
AE15151	Industrial Aerodynamics	3	0	0	3
AE15152	Experimental Aerodynamics	3	0	0	3
AE15153	Hypersonic Aerodynamics	3	0	0	3
AE15154	Boundary layer Theory	3	0	0	3

ELECTIVE II

Course Code	Course Title	L	T	P	C
AE15251	Aircraft Rules and Regulation	3	0	0	3
AE15252	Helicopter Maintenance	3	0	0	3
AE15253	Aero Engine Repair and Maintenance	3	0	0	3
AE15254	Airframe Maintenance and Repair	3	0	0	3

SEMESTER V

AE15501 **AERODYNAMICS II** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire the basic concepts of compressible flow
- understand the behavior of airflow both internal and external in compressible flow regime with particularemphasis on supersonic flows.
- know the theory behind the formation of shocks and expansion fans in Supersonic flows.
- obtain the potential flow in two dimensional compressible flow.
- introduce the methodology of measurements in Supersonic flows.

UNIT I FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW 10

Aerodynamics variables and flow physics. Aerodynamic forces and moments. Definition of Compressible flow. Adiabatic steady state flow equations. Compressibility, continuity, momentum and energy equations for steady one dimensional flow, compressible Bernoulli's equation, area – mach number – velocity relation, mach Cone, mach angle. Choked flow. Numerical Problems

UNIT II INVISCID, COMPRESSIBLE FLOWS 8

One dimensional flow equations. Quasi-one dimensional flow. one dimensional isentropic flow through variable area duct, critical conditions, characteristic mach number, area-mach number relation, maximum discharge velocity,operating characteristics of nozzles, Isentropic flow through supersonic nozzle.

UNIT III SHOCK AND EXPANSION WAVES 10

Normal shock relations, Prandtl's relation, Hugoniot equation, Rayleigh Supersonic Pitot tube equation, Oblique shocks, θ-β-M relation, Shock Polar, Reflection of oblique shocks, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Attached and detached shocks, Introduction to viscous flow. Introduction to boundary-layers, shock wave boundary-layer interaction.

UNIT IV TWO DIMENSIONAL COMPRESSIBLE FLOW 10

Potential equation for 2-dimensional compressible flow, Linearisation of potential equation, perturbation potential, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule, Linearised supersonic flow, Method of characteristics

UNIT V HIGH SPEED FLOWS 7

Critical Mach number, Drag divergence Mach number, Shock Stall, Supercritical Airfoil Sections, Transonic area rule, Swept wing, wave drag, Wind tunnels for transonic, Supersonic and hypersonic flows, shock tube, Gun tunnels, Supersonic flow visualization methods

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand and apply the fundamental aspects of compressible flow
- numerate the calculations in inviscid and compressible flow
- compute the calculations related to shock and expansion waves
- compute the equations for various parameters in two dimensional compressible flow
- elaborate the visualization methods of flow properties

TEXT BOOKS

1. Anderson, J. D, "Modern Compressible Flow", McGraw-Hill & Co., 2002.
2. Rathakrishnan., E,"Gas Dynamics", Prentice Hall of India, 2004.

REFERENCES

1. Shapiro, A. H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., "Elements of Gas Dynamics", McGraw- Hill & Co., 1989.
3. Oosthuizen,P.H., & Carscallen,W.E., "Compressible Fluid Flow", McGraw- Hill & Co.,1997.

WEB LINKS

1. http://nptel.ac.in/courses/101105059/
2. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	3	2	-	-	-	3	2	3	3
CO2	3	2	3	3	2	2	2	-	-	-	3	2	3	2
CO3	-	2	1	3	2	2	3	-	-	-	3	2	2	3
CO4	2	2	3	3	2	2	3	-	-	-	3	2	2	2
CO5	2	2	2	2	3	3	2	-	-	-	2	2	3	2

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AE15502 AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study about the various ground handling procedures of an aircraft
- know about the ground servicing of Aircraft Subsystems.
- learn the safety procedures and precautions requirements
- understand the inspection procedures
- introduce the basic hardware, materials, system processes involved in aircraft

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 9

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 8

Air conditioning and pressurization system and their maintenance – Oxygen and oil systems and their maintenance – Ground units and their maintenance.

UNIT III MAINTENANCE OF SAFETY 8

Shop safety – Electrical Safety – Fire Protection and Fire Safety – Safety Around: Compressed Gases, Hazardous Materials, Machine Tools –Flight Line Safety–Safety Around Airplanes and Helicopters–Environmental cleanliness – Precautions

UNIT IV INSPECTION 10

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, MATERIALS, SYSTEM PROCESSES 10

Hand tools – Precision instruments – Special tools and equipments in airplane maintenance shop– Identification terminology – Specification and correct use of various aircraft hardware (i.e. nuts, bolts,rivets, screws etc) American and British systems of specifications – Threads, gears, bearings, etc –Drills, tapes and reamers – Identification of all types of fluid line fittings Materials. Metallic and nonmetallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- elaborate the ground handling operations of an aircraft
- carry out ground servicing of critical aircraft systems
- identify the safety requirements in the maintenance bay
- compute the effective inspection required for various parts of an aircraft
- compare the specifications standards of aircraft hardware systems

TEXT BOOKS

1. A&P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996
2. A&P Mechanics," General Hand Book", F A A Himalayan Bok House, New Delhi, 1996

REFERENCES

1. Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993
2. Brimm D.J. and Bogges H.E., „Aircraft Maintenance", Pitman Publishing corp., New York, 1940.
3. Larry Reithmeir, „Aircraft Repair Manual", Palamar Books, Marquette, 1992.
4. Dale Crane, Aviation Maintenance Technician: Powerplants, 2nd edition, Aviation Supplies & Academics Inc,2005
5. Jeppesen Sanderson, Standard Aviation Maintenance Handbook, Jeppesen & Company, 2003

WEB LINKS

1. https://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_handbook/
2. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/pilot_handbook.pdf

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	3	2	-	-	-	-	2	3	3
CO2	2	2	1	2	2	3	3	-	-	-	-	2	3	2
CO3	2	3	2	2	3	2	2	-	-	-	-	2	2	3
CO4	3	3	2	2	3	2	2	-	-	-	-	2	2	2
CO5	2	2	2	2	3	1	2	-	-	-	-	2	3	2

AE15503 **AIRCRAFT STRUCTURES II** **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- introduce the various structural components of aircrafts
- familiarize with different section of beams subjected to various types of loading.
- know the theoretical and methodological approaches to design aircraft structures.
- provide the knowledge on the importance of structural analysis of aircraft.
- study the behavior of various aircraft structural components under different types of loads.

UNIT I UNSYMMETRICAL BENDING **13**

Bending stresses in beams of unsymmetrical sections -K-method-Neutral axis method and Principle axis Method-Bending of symmetric sections with skew loads.

UNIT II SHEAR FLOW IN OPEN SECTIONS **16**

Thin walled beams – Concept of shear flow – shear centre – Elastic axis – one axis of symmetry – wall effective and ineffective in bending – unsymmetrical beam sections

UNIT III SHEAR FLOW IN CLOSED SECTIONS **16**

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 **16**

Rectangular sheets under compression – Local buckling stress of thin walled sections – Crippling stresses by Needha's and Gerard's methods – Sheet stiffener panels – Effective width – inter rivet and sheet wrinkling failures.

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE **14**

Shear resistant web beams – Tension field web beams (Wagner Beam) – Shear and bending moment distribution for cantilever and semi-cantilever types of beams – loads on aircrafts – lift distribution – V-n diagram – Gust loads.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- analyze the response of structures due to unsymmetrical bending.
- identify and analyze structural problems commonly encountered in aircrafts.
- understand the theory behind the failure of various structures.
- determine the effect of a variety of loading and support conditions on the small deflection of beams and plates
- identify various types of structural components and their loading pattern.

TEXT BOOKS

1. Megson, T.H.G., "Aircraft Structures for Engineering Students", 4th edition Butterworth Heinemann, (2002).
2. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri – state off set company, USA, (1985).

REFERENCES

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw–Hill, N.Y., (1993).
2. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, (1993).
3. Michael Chun-Yung Niu, "Airframe Structural Design: Practical Design Information and Data on Aircraft Structures", 2nd edition, Adaso/Adastra Engineering Center, (2006).
4. Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, (1997)
5. Lakshmi Narasaiah G," Aircraft Structures", BSP Books Pvt.Ltd-Hyderabad.

WEB LINKS

1. http://nptel.ac.in/courses/105106049/65
2. https://pritamashutosh.wordpress.com

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	-	3	-	-	-	-	2	3	3
CO2	3	2	2	2	3	-	3	-	-	-	3	2	3	2
CO3	3	2	2	2	2	3	2	-	-	-	2	2	2	3
CO4	3	3	3	2	2	-	2	-	-	-	3	2	2	2
CO5	3	3	3	3	3	2	3	-	-	-	3	2	3	2

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AE15504 **FLIGHT DYNAMICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire the necessary background for understanding the physical behavior of flight during maneuvers.
- familiarize the application various of aircraft components towards the stability and control.
- study and understand about various longitudinal stability characters.
- impart students with a sound fundamental in using importance of aileron and rudder controls
- understand the basic concepts of special maneuvers like spin, Dutch roll, auto rotation and spiral divergence.

UNIT I CRUISING FLIGHT PERFORMANCE **9**

Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle – Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines . Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight – Conditions for minimum drag and power required.

UNIT II MANOEUVERING FLIGHT PERFORMANCE **9**

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, and load minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle factor – limitations on turn - V-n diagram and load factor.

UNIT III STATIC LONGITUDINAL STABILITY **9**

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes - Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability – Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location – Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points- Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing.

UNIT IV LATERAL AND DIRECTIONAL STABILITY **9**

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements – One engine inoperative condition - Rudder lock.

UNIT V DYNAMIC STABILITY **9**

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick – Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the performance of an aircraft under various operating conditions.
- compute the various load factor performance.
- improve the aspect of stability and control of an aircraft.
- compare the various abnormal conditions during flight.

- elaborate the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions.

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:,Inc, NY, 1988.
2. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition,Issac Pitman, London, 1981.
4. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979.

WEB LINKS

1. http://nptel.ac.in/courses/101106041/
2. http://nptel.ac.in/courses/101106043/1
3. http://nptel.ac.in/courses/101106042/

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	-	-	-	-	-	2	2	3	3
CO2	2	2	3	2	2	2	-	-	-	-	2	2	3	2
CO3	2	2	3	3	2	3	-	-	-	-	1	2	2	3
CO4	2	3	2	2	3	2	-	-	-	-	3	2	2	2
CO5	1	2	2	2	3	2	-	-	-	-	3	2	3	2

AE15505 **ROCKET PROPULSION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- study in detail about fundamentals of chemical rockets, rocket propulsion and advanced propulsion techniques
- acquire an overview of various rocket technologies and applications.
- impart students with a sound fundamental in gas dynamics, thermo chemistry, heat transfer, and vehicle dynamics as related to rocket motor/vehicle analysis.
- familiarize students with a sound fundamental in analyzing /designing various rocket propulsion systems such as liquid propellant rocket motors, solid propellant rocket motors.
- understand about the multi-stage launch vehicles, arc jets, solid core nuclear thermal rocket motors,and ion thrusters.

UNIT I DEFINITIONS AND FUNDAMENTALS **9**

Operating principle of chemical rockets. Definitions: Rocket thrust, Exhaust velocity, Specific Impulse, Vehicle acceleration, Effective exhaust velocity, Characteristic velocity, Mass ratio, Propellant mass fraction, Burning time, Total impulse. Thrust coefficient, Isentropic flow throw nozzles, Rocket nozzle classifications. Under and over expanded nozzles, Optimum expansion. Numerical Problems.

UNIT II IGNITION SYSTEMS IN ROCKETS **9**

Types of solid propellant rocket igniters – Pyrotechnic igniters and pyrogen igniters. Igniter Design spreading Considerations: Igniter mass and chamber volume, Ignition Chain: Ignition delay, mode of heat transfer, flame Deflagration and Detonation. Hypergolic ignition. Ignition systems in liquid rockets.

UNIT III SOLID PROPELLANT ROCKETS **9**

Selection criteria of solid propellants – Important hardware components of solid rockets. Propellant grain design considerations. Burn rate. Internal ballistics - Pressure-time curve. Starting transient, erosive burning, Rocket performance considerations – Staging of rockets. Thrust vector control. Thrust termination techniques, Numerical problems.

UNIT IV LIQUID PROPELLANT ROCKETS **9**

Liquid propellant rocket engine fundamentals. Liquid propellants. Propellant feed systems. Selection of liquid propellants. Valves and pipe lines. Thrust chambers. Injectors, combustion chamber and nozzle, Combustion Instability. Secondary injection thrust vector control in liquid rockets – Cooling in liquid rockets. Numerical Problems. Introduction to hybrid rockets – Relative advantages of liquid rockets over solid rockets. Types of Rocket tests. Rocket exhaust plumes.

UNIT V ADVANCED PROPULSION TECHNIQUES **9**

Cryogenic rockets, Satellite thrusters, Electric rockets, Ion propulsion techniques, Nuclear rockets – Types, Solar sail, Anti-matter propulsion, Preliminary Concepts in nozzle less propulsion.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the fluid flow in a rocket nozzle
- compute the preliminary heat transfer calculations in a rocket nozzle

- design various rocket motor systems to satisfy a wide range of applications
- elaborate about the solid-core nuclear thermal rockets, arc jets, and ion thrusters
- analyze a rocket engine system to determine its specific impulse and performance.

TEXT BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th edition.
2. Kou.K.K and Summerfield.M., Fundamental Aspects of Solid Propellant Rockets, " Progress in Astronautics and Aeronautics, AIAA, Vol.90, 1982.

REFERENCES

1. Barrere.M, Rocket Propulsion, Elsevier Publishing Company, New York, 1960 .
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" 2nd Edition Pearson Education, 1999.
3. Gordon Oates, "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
4. bJ.W.Cornelisse, H.F.R.Schoyer, K.F.Wakker, "Rocket Propulsion and Spaceflight Dynamics," Pitman, London. (1979)

WEB LINKS

1. http://nptel.ac.in/courses/112106073/
2. http://nptel.ac.in/courses/101104019/
3. http://www.nptelvideos.in/2012/12/rocket-propulsion.html

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	-	-	-	3	2	3	3
CO2	2	3	3	2	3	2	2	-	-	-	3	2	3	2
CO3	-	1	3	2	3	2	2	-	-	-	2	-	2	3
CO4	-	3	2	3	2		3	-	-	-	3	2	2	2
CO5	-	2	3	3	3	3	-	-	-	3	2	2	3	2

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AE15506 **EXPERIMENTAL STRESS ANALYSIS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the relation between the mechanics theory and experimental stress analysis.
- bring consciousness on experimental method of finding the response of the structure to different types of load.
- establish the fundamental concepts and newly experimental techniques.
- use the experimental techniques on the practical problems.
- know the fundamental aspects of different non destructive testing techniques

UNIT I EXTENSOMETERS AND DISPLACEMENT SENSORS **8**

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors.

UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES **12**

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, Rosette analysis, stress gauges, load cells, Data acquisition, six component balance.

UNIT III PHOTOELASTICITY **11**

Two dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, Transmission photoelasticity, Jones calculus, plane and circular polariscopes, Interpretation of fringe pattern, Calibration of photoelastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

UNIT IV BRITTLE COATING AND MOIRE TECHNIQUES **7**

Relation between stresses in coating and specimen, use of failure theories in brittle coating, Moire method of strain analysis.

UNIT V NON – DESTRUCTIVE TESTING **7**

Fundamentals of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonic, Eddy Current testing, Fluorescent Penetrant Testing,

TOTAL PERIODS 45

COURSE OUTCOMES

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

- elaborate the various experimental techniques which is used to determine the structural properties
- execute the physics of strain measurement techniques.
- analyse the principles and techniques of photoelastic measurement to perform a structural analysis.
- perform the Moire method of analysis
- describe the different method of NDT and its applications.

TEXT BOOKS

1. Dr. Sadhu Singh, "Experimental stress analysis", Khanna Publications.(1989).
2. Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", College House Enterprises, New York, (2005).

REFERENCES

1. Srinath, L.S., Raghava, M.R., Lingaiah,K., Garagesha,G. Pant B. and Ramachandra,K., "Experimental Stress Analysis", Tata McGraw-Hill, NewDelhi,(1984).
2. Ramesh K, "Digital Photoelasticity, Advanced Techniques and Applications", Springer,(2000).
3. Jindal U C, "Experimental Stress Analysis", 1st edition, Pearson, (2012).
4. Allesandro Freddi, Giorgio Olmi, Luca Cristofolini, "Experimental Stress Analysis for Materials and Structures", Springer, (2015).
5. Srinivas J, "Stress Analysis and Experimental Techniques An Introduction", Alpha Science Int'l Ltd, (2011).

WEB LINKS

1. http://nptel.ac.in/courses/112106068/
2. https://swayam.gov.in/course/1309-experimental-stress-analysis-an-overview

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	-	2	-	2	-	-	2	3	3
CO2	2	3	2	3	2	-	2	-	-	-	-	3	3	2
CO3	-	2	3	2	3	-	3	-	3	-	-	2	2	3
CO4	3	2	3	2	3	-	2	-	3	-	-	2	2	2
CO5	2	1	3	3	2	-	3	-	2	-	-	2	3	2

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AE15507 **AIRCRAFT STRUCTURES II LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the behavior of structural components with different loading conditions.
- know the shear center location of open and closed section
- find the fringe value of the material
- gain knowledge of tensioned specimen

LIST OF EXPERIMENTS

1. Unsymmetrical bending of Z-section beams
2. Shear centre location for open channel sections
3. Shear centre location for closed D-sections
4. Constant strength beam
5. Flexibility matrix for cantilever beam
6. Beam with combined loading
7. Calibration of Photo- elastic materials using plane and circular polariscope
8. Stresses in circular discs and beams using photo elastic techniques
9. Determination of natural frequencies of different materials with boundary conditions
10. Wagner beam – Tension field beam with gauge mounting practices

TOTAL PERIODS 30

COURSE OUTCOMES

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

- evaluate the numerical analysis of structural components.
- estimate the shear center of various section
- identify the fringe value of the materials
- fabricate the different composite laminates

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	-	2	-	3	3
CO2	3	2	1	-	2	-	3	-	3	-	3	-	3	2
CO3	3	2	2	-	3	-	2	-	2	-	2	-	2	3
CO4	3	2	2	-	2	-	2	-	3	-	2	-	2	2

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AE15508 **PROPULSION LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts in aerospace propulsion.
- gain the knowledge about piston engine and jet engine components.
- familiarize student with a calibration test.
- learn the testing of different jets and velocity profile.

LIST OF EXPERIMENTS

1. Velocity profiles of free jets.
2. Velocity profiles of wall jets.
3. Study of an aircraft piston engine.
4. Study of an aircraft jet engine compressor.
5. Study of jet engine combustion chamber.
6. Study of jet engine turbine.
7. Study of forced convective heat transfer over a flat plate.
8. Study of free convective heat transfer over a flat plate

TOTAL PERIODS 30

COURSE OUTCOMES

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

- analyze the performance of various aircraft piston and gas turbine engines components.
- compute the flow behavior of jets
- identify various testing methods of variable area ducts, jet engine components
- estimate the calorific value of various types of fuels.

Mapping of Course Outcomes with Program Outcomes
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COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	3	2	-	3	-	3	2	3	3
CO2	2	3	3	3	2	2	2	-	3	-	2	2	3	2
CO3	3	2	2	3	3	3	2	-	2	-	3	-	2	3
CO4	2	2	-	-	2	3	2	-	3	-	3	-	2	2

AE15601 COMPOSITES MATERIALS AND STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn about the micro structures of composite
- understand the concept of macro structure composite
- gain the knowledge of laminate types and failure criteria
- familiarize the sandwich construction
- know the fabrication methods of composite

UNIT I MICROMECHANICS 10

Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach – fiber volume ratio – mass fraction – density of composites - effect of voids in composites.

UNIT II MACROMECHANICS 8

Generalized Hooke's Law - Plane stress and plane strain- elastic constants for anisotropic, orthotropic an isotropic materials -macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis failure theories of a lamina.

UNIT III LAMINATED PLATES 10

Governing differential equation for a general laminate, angle ply and cross ply laminates. stress – strain relations for a laminate - different types of laminates - Failure criteria for composites.

UNIT IV SANDWICH CONSTRUCTIONS 10

Basic design concepts of sandwich construction -materials used for sandwich construction – failure modes of sandwich panels. Application of sandwich composites.

UNIT V FABRICATION PROCESS AND REPAIR SCHEME 7

Various open and closed mould processes. Manufacture of fibers – types of resins and properties and applications –importance of repair and different types of repair techniques in composites – autoclave and non-auto clave methods.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the properties of fiber and matrix materials used in commercial composite materials.
- analyze the structural properties of composite materials.
- elaborate the conventional failure theories of composite materials
- execute the concept of sandwich construction
- develop the knowledge in fabrication process

TEXT BOOKS

1. R. M. Jones, "Mechanics of Composite Materials", 2nd Edition, Taylor & Francis publication,2014.
2. Prof.R.Velmurugan, "e-Book on Composite Materials", IIT Madras.

REFERENCES

1. R.F. Gibson," Principles of composite material mechanics",3rd Edition, CRC press.2015
2. Dr.K.V.Nagendra Gopal,"e-Book on Composite Structures", IIT Madras.
3. D. Agarwal, L. J. Broutman and K. Chandrashekhara, "Analysis and Performance of Fiber Composites", 3rd Edition, John Wiley & Sons.

WEB LINKS

1. http://nptel.ac.in/courses/101104010/
2. http://www.ae.iitkgp.ernet.in/ebooks/chapter1.html

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	3	2	3	-	3	-	-	-	3	2	3	3
CO2	-	3	3	3	2	-	2	-	-	-	2	2	3	2
CO3	-	1	1	2	3	-	3	-	-	-	3	2	2	3
CO4	-	3	1	2	3	-	2	-	-	-	3	2	2	2
CO5	-	2	2	3	2	-	2	-	-	-	3	2	3	2

AE15602 AIR TRAFFIC CONTROL AND PLANNING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the procedure of the formation of aerodrome and its design.
- learn about the various maintenance activities for airport maintenance.
- understand the air traffic control, procedure and air traffic service.
- familiarize the procedure of the formation of aerodrome and its design and air traffic control.
- acquire the knowledge about the various navigation and lightning facilities.

UNIT I BASIC CONCEPTS 9

Objectives of ATS - parts of ATC service - scope and provision of ATCS -VFR & IFR operations - classification of ATS air spaces -varies kinds of separation - altimeter setting procedures – Establishment designation and identification of units providing ATS -division of responsibility of control.

UNIT II AIR TRAFFIC SERVICES 9

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant Points RNAV And RNP - Vertical, lateral and longitudinal separations based on time distance - ATC Clearances flight plans - position report. Comparison of various ATC services.

UNIT III FLIGHT INFORMATION, ALERTING SERVICES, COORDINATION, EMERGENCY PROCEDURES AND RULES OF THE AIR 9

Flight Information, Alerting Services, Coordination, Emergency Procedures and Rules of the Air Radar service basic radar terminology - identification procedures using primary / secondary radar - performance checks use of radar in area and approach control services - assurance control and coordination between radar and non radar control - emergencies - flight information and advisory service - alerting service and emergency procedures - rules of the air. Study about communication between aircraft and ATC.

UNIT IV AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data - basic terminology - aerodrome reference code - aerodrome reference point - aerodrome elevation - aerodrome reference temperature - instrument runway, physical characteristics; length of primary / secondary runway - width of runways - minimum distance between parallel runways etc – obstacles restriction. Comparison between domestic and international airports.

UNIT V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 9

Visual aids for navigation wind direction indicator - landing direction indicator - location and characteristics of signal area - markings, general requirements - various markings - lights, general requirements – aerodrome beacon, identification beacon - simple approach lighting system and various lighting systems - VASI & PAPI - visual aids for denoting obstacles; object to be marked and lighter - emergency and other services.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- exhibit the concept of air traffic rules and clearance procedures for airline operation.
- analyze the various air traffic data for air traffic services.

- elaborate the influence of aerodrome design factors for service establishments.
- gain knowledge on aerodrome design.
- compare the different services of Air Traffic Control.

TEXT BOOKS

1. Virendra kumar and Sathish Chandra, "Airport Planning and Design", Galgotia publications Pvt Ltd, New Delhi, 2012.
2. Aeronautical Information Publication (India) Vol. I & II, the English book store, 17-1, Connaught Circus, New Delhi, 2006

REFERENCES

1. Nolan M. S, "Fundamentals Air Traffic Control", Latest Edition, YESDEE Publishers, 2010
2. Seth B. Young, Alexander T. Wells, "Airport Planning and Management" McGraw-Hill Education, New Delhi,2011.

WEB LINKS

1. http://nptel.ac.in/courses/105101008/downloads/cete_40.pdf
2. http://nptel.ac.in/courses/105107123/40
3. http://nptel.ac.in/courses/108105057/Pdf/Lesson-28.pdf

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	3	2	-	3	-	3	2	3	3
CO2	2	3	3	3	2	2	2	-	3	-	2	2	3	2
CO3	3	2	2	3	3	3	2	-	2	-	3	-	2	3
CO4	2	2	-	-	2	3	2	-	3	-	3	-	2	2
CO5	2	3	2	1	2	3	-	-	3	-	-	2	3	2

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AE15603 **FINITE ELEMENT METHOD** **3 2 0 4**

COURSE OBJECTIVES

To enable the students to

- equip the students with the finite element analysis fundamentals.
- understand the concept of numerical analysis of structural components.
- study domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
- acquire the basic knowledge of Isoparametric Element Formulation.
- apply the numerical approximations to common structures and solid boundary value problems

UNIT I UNSYMMETRICAL BENDING **15**

Review of various approximate methods – variational approach and weighted residual approach application to structural mechanics problems. finite difference methods- – Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS **16**

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element - problems for various loadings and boundary conditions – 2D and 3D Frame elements - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT III CONTINUUM ELEMENTS **14**

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric element.

UNIT IV ISOPARAMETRIC ELEMENTS **14**

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

UNIT V HEAT TRANSFER PROBLEM AND METHODS OF SOLUTIONS **16**

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. bandwidth- elimination method and method of factorization for solving simultaneous algebraic equations – Features of software packages, sources of error.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- exhibit the basic finite element formulation techniques.
- compute the mathematical and physical principles underlying the FEM as applied to solid mechanics, dynamics, and thermal analysis.
- derive equations in finite element methods for 1D, 2D and 3D Problems.
- formulate and solve basic problems in heat transfer, solid mechanics.
- analyze more complex problems (in solid mechanics or thermal analysis) using the commercial FEM code ANSYS.

TEXT BOOKS

1. Reddy J.N. "An Introduction to Finite Element Method", Third Edition, McGraw-Hill, (2005)

2. Chandrupatla T. R., and Belegundu A.D, "Introduction to Finite Elements Engineering", 3rd Edition, Pearson Education (2002).
3. M. J. Fagan "Finite Element Analysis : Theory and Practice" Pearson Education Limited (1992)

REFERENCES

1. Robert D Cook, David S Malkus, Michael E Plesha "Concepts and applications of finite element analysis", 4th edition, John Wiley and Sons, Inc., (2008).
2. Tirupathi.R. Chandrupatla and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Fourth Edition, (2011).
3. Rao. S.S., "Finite Element Methods in Engineering," Butterworth and Heinemann, 2001Data on Aircraft Structures", 2nd edition, Adaso/Adastra Engineering Center, (2006).
4. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
5. Larry J. Segerlind, „Applied finite element analysis", 2nd edition, John Wiley and Sons, Inc.(1985).

WEB LINKS

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FiniteElementMethod
2. https://www.nafems.org

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	-	-	-	-	2	3	3
CO2	2	3	3	2	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	2	3	2	3	-	-	-	-	-	-	2	2	2
CO5	2	1	3	3	3	-	-	-	-	-	-	2	3	2

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AE15604 **AERO CAD LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- develop skill to use software to create 2D and 3D models.
- train the students about the different types of operation by using CAD software.
- teach the student to design the layout of control system and engine components
- design the different aircraft parts by using software.

LIST OF EXPERIMENTS

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout and Analysis typical wing structure.
5. Layout and Analysis typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

TOTAL PERIODS 30

COURSE OUTCOMES

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

- design the 2D and 3D model
- design the aircraft parts by using software
- prepare the layout of aircraft component
- develop the model aircraft component using software

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	-	3	-	-	-	-	-	-	2	3	3
CO2	1	2	2	-	1	-	-	-	-	-	-	2	3	2
CO3	1	2	2	-	3	-	-	-	-	-	-	2	2	3
CO4	1	2	2	1	3	-	-	-	-	-	-	2	2	2

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AE15605 AIRCRAFT ENGINE AND STRUCTURES REPAIR LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- give training on riveting, patchwork, welding and carpentry
- learn the dismantling procedure for a piston engine.
- practice the different patch repairs and wood gluing joint
- know the composite materials with different resins.

LIST OF EXPERIMENTS

1. Dismantling of a piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Piston Engine Components - dimensional checks.
4. Piston – Engine reassembly.
5. Engine starting procedures.
6. Aircraft wood gluing-single & double scarf joints
7. Welded single & double V-joints.
8. Fabrication of Composite Materials
9. Riveted Patch repairs
10. Tube bending and flaring
11. Study on MIG, TIG & PLASMA welding of aircraft components

TOTAL PERIODS 60

COURSE OUTCOMES

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

- identify the engine components
- obtain the repair work of airframe
- analyze riveted joints
- inspect the piston engine defects.

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	-	-	2	2	3	3
CO2	2	2	3	3	1	2	-	-	-	-	3	2	3	2
CO3	1	2	3	1	1	-	-	-	-	-	2	2	2	3
CO4	3	2	2	1	3	2	-	-	-	-	3	2	2	2

ELECTIVE I

AE15151 INDUSTRIAL AERODYNAMICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of wind energy collectors
- understand the aerodynamics of ground vehicles
- gain the basic concepts of building aerodynamics
- build up necessary features for induced vibrations
- acquire knowledge about the industrial gas turbines

UNIT I WIND ENERGY COLLECTORS 9

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height. Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

UNIT II GROUND VEHICLE AERODYNAMICS 9

Power requirement and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of cars, trains and hovercraft.

UNIT III BUILDING AERODYNAMICS 9

Pressure distribution on low rise buildings, Wind forces on buildings, Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and Architectural aerodynamics.

UNIT IV FLOW INDUCED VIBRATIONS 9

Effect of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Buffeting, Vortex Shedding, Galloping and flutter.

UNIT V INDUSTRIAL GAS TURBINES 9

Working of gas turbines, Special features of industrial and stationary gas turbines as compared to aircraft gas turbines.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- exhibit the basic components and functions of wind energy collectors
- elaborate the aerodynamic performance of ground vehicles
- analyze about the aerodynamics of various building
- identify the effects and functions of induced vibrations
- classify the subsystem of Industrial turbines

TEXT BOOKS

1. T. Yomi Obidi, "Ground Vehicle Aerodynamics with Applications", SAE International, 2014.
2. Lawson,"Building Aerodynamics", Cambridge University Press, 2010.

REFERENCES

1. Tomomichi Nakamura, Shigehiko Kaneko, "Flow-Induced Vibrations: Classifications and Lessons fromPractical Experiences", Second Edition, Academic Press, 2013.
2. A. R. Jha, "Wind Turbine Technology", CRC Press, 2010.

WEB LINKS

1. http://www.wind-power-program.com/betz.htm
2. https://ntl.bts.gov/DOCS/ch2.html

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	2	-	-	-	2	-	2	2	3	3
CO2	3	2	3	3	3	3	-	-	-	-	3	-	3	2
CO3	2	2	3	3	2	3	-	-	3	-	2	2	2	3
CO4	-	1	3	2	2	2	-	-	3	-	3	2	2	2
CO5	-	3	-	3	2	2	-	-	3	-	3	2	3	2

AE15152 EXPERIMENTAL AERODYNAMICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the students about the practical elements of experimental aerodynamics and to develop an appreciation for how aerodynamic data are acquired.
- gain a working knowledge of experimental test facilities, techniques and equipment commonly usedin the field of experimental aerodynamics
- present the flow visualization techniques involved in aerodynamic testing
- understand the instruments which is used to measure the physical properties such velocity, pressure and temperature
- provide the students with an opportunity to apply modern instrumentation and measurement techniques to the acquisition of aerodynamic data and understand the inherent limitations of eachtechnique.

UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS 10

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments –Performance terms associated with measurement systems – Direct measurements – Analogue methods – Flow visualization –Components of measuring systems – Importance of model studies - Experiments on Taylor –Proudman theorem and Ekman layer.

UNIT II WIND TUNNEL MEASUREMENTS 8

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence- Wind tunnel balance – Principle and application and uses.

UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS 10

Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Shadowgraph - Schlieren system – Background Oriented Schliren (BOS) System –Hydraulic analogy – Hydraulic jumps – Electrolytic tank.

UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS 10

Pitot-Static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Hot-film anemometry – Laser Doppler Velocimetry (LDV) – Particle Image Velocimetry (PIV) – Pressure Sensitive Paints – Pressure measurement techniques. Pressure transducers, Temperature measurements.

UNIT V DATA ACQUISITION SYSTEMS AND UNCERTAINTY ANALYSIS 7

Data acquisition and processing – Signal conditioning - Estimation of measurement errors – Uncertainty Calculation. Uses of uncertainty analysis.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- execute the basic measurements used in aerodynamics
- operate different types of wind tunnels and calibration of the instruments associated with them.
- elaborate the various instruments used in wind tunnel.

- identify the various instruments used to measure the air properties
- analyze the uncertainty situations by using instruments.

TEXT BOOKS

1. F Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids", CRC Press - Taylor & Francis, 2007.
2. Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

REFERENCES

1. Pavian, Henry Christensen, "Experimental Aerodynamics", 1st edition, Pitman Pub, 2006.
2. G P Russo, "Aerodynamic Measurements: From Physical Principles to Turnkey Instrumentation", Woodhead publishing, 2011
3. Rae W.H., and Pope A., "Low Speed Wind Tunnel Testing", John Wiley Publication, 2014.

WEB LINKS

1. http://nptel.ac.in/courses/101106040/
2. http://soliton.ae.gatech.edu/labs/windtunl/

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	2	-	-	-	2	-	2	2	3	3
CO2	3	2	3	3	3	3	-	-	-	-	3	-	3	2
CO3	2	2	3	3	2	3	-	-	3	-	2	2	2	3
CO4	-	1	3	2	2	2	-	-	3	-	3	2	2	2
CO5	-	3	-	3	2	2	-	-	3	-	3	2	3	2

AE15153 HYPERSONIC AERODYNAMICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of hypersonic aerodynamics
- understand the methods for hypersonic inviscid flows
- know about the viscous hypersonic flow theory
- build up necessary features for viscous interactions in hypersonic flows
- study about the high temperature effects in hypersonic flows

UNIT I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS 9

Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics - concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS 9

Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.

UNIT III VISCOUS HYPERSONIC FLOW THEORY 9

Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non self similar boundary layers – solution methods for non self similar boundary layers – aerodynamic heating and its adverse effects on airframe.

UNIT IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 9

Introduction to the concept of viscous interaction in hypersonic flows - Strong and weak viscous interactions - hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.

UNIT V HIGH TEMPERATURE EFFECTS IN HYPERSONIC FLOWS 9

Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb's free energy and entropy - chemically reacting boundary layers – recombination and dissociation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- exhibit the components and functions hypersonic aerodynamics
- carry out the aerodynamic performance of hypersonic inviscid flows
- elaborate the viscous hypersonic flow theory
- identify the effects and functions of viscous interactions in hypersonic flows
- analyze the effects in hypersonic flows

TEXT BOOKS

1. John D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", Mc.Graw hill Series,New York, 1996.

REFERENCES

1. John D. Anderson. Jr., "Modern Compressible flow with historical Perspective", Mc.Graw Hill Publishing Company, New York, 1996.

2. John T. Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc., Washington. D.C.,1994.

WEB LINKS

1. http://nptel.ac.in/courses/101103003/
2. https://arc.aiaa.org/doi/abs/10.2514/3.25879

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	2	-	-	-	2	-	2	2	3	3
CO2	3	2	3	3	3	3	-	-	-	-	3	-	3	2
CO3	2	2	3	3	2	3	-	-	3	-	2	2	2	3
CO4	-	1	3	2	2	2	-	-	3	-	3	2	2	2
CO5	-	3	-	3	2	2	-	-	3	-	3	2	3	2

AE15154 **BOUNDARY LAYER THEORY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of equations of viscous flow
- understand the methods for solutions of viscous flow equations
- attain the knowledge about the laminar boundary layer equations
- build up necessary features for turbulent boundary layer equations
- study about the boundary layers equations

UNIT I FUNDAMENTAL EQUATIONS OF VISCOUS FLOW **9**

Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non dimensionalising the basic equations and boundary conditions, vorticity considerations, creeping flow, boundary layer flow

UNIT II SOLUTIONS OF VICOUS FLOW EQUATIONS **9**

Solutions of viscous flow equations, Couette flows, Hagen-Poisuelle flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.

UNIT III LAMINAR BOUNDARY LAYER EQUATIONS **9**

Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation- similarity solutions, Blasius solution for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations

UNIT IV TURBULENT BOUNDARY LAYEREQUATIONS **9**

Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations – Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient, Eddy Viscosity, mixing length , Turbulence modeling

UNIT V COMPRESSIBLE BOUNDARY LAYERS EQUATIONS **9**

Compressible boundary layer equations, Recovery factor, similarity solutions, laminar supersonic Cone rule, shock-boundary layer interaction

TOTAL PERIODS 45

COURSE OUTCOMES

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

- exhibit the basic components and functions equations of viscous flow
- carry out the solutions of viscous flow equations
- write the basic boundary layer equations
- identify the effects and functions of turbulent boundary layer equations
- analyze the effects in boundary layers equations

TEXT BOOKS

1. Reynolds, A, J., Turbulent Flows Engineering, John Wiley and Sons, 1980.

REFERENCES

1. White, F. M., Viscous Fluid Flow, McGraw-Hill & Co., Inc., New York., 2005.
2. Schlicting, H., Boundary Layer Theory, McGraw-Hill, New York, 2000.

WEB LINKS

1. http://nptel.ac.in/courses/112104118/ui/Course_home-9.htm
2. https://lecturenotes.in/topic/755/fluid-mechanics-and-hydraulic-machines/boundary-layer-theory/

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	-	2	-	-	-	2	2	3	3
CO2	3	3	2	3	2	-	2	-	-	-	3	2	3	2
CO3	2	2	3	2	3	-	3	-	-	-	3	2	2	3
CO4	3	2	3	2	3	-	3	-	-	-	3	2	2	2
CO5	3	1	3	2	3	-	3	-	-	-	2	2	3	2

AE15251 AIRCRAFT RULES AND REGULATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- build up necessary background for understanding the civil air rules and regulations which are being followed by directorate general of civil aviation.
- understand the procedure for issue of civil aviation requirements.
- learn the objective and target of airworthiness directorate of civil aviation requirements.
- introduce the students about civil aircraft safety rules and regulations which are being followed by directorate general of civil aviation and FAA.
- study various civil flight safety operational procedures.

UNIT I AIRWORTHINESS 9

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.C.A.R. Series - "B" Issue Approval of Cockpit Check List, MEL, CDL: Deficiency list (MEL & CDL). Preparation and use of cockpit checklist and emergency list

UNIT II C.A.R. SERIES C: DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING 9

Defect recording, reporting, investigation, rectification and analysis; flight report; reporting and rectification of defects observed on aircraft; analytical study of in-flight readings & recordings; maintenance control by reliability method. Case study: Comparison between aircraft reliability and Maintainability. C.A.R. Series D Reliability and Aircraft Maintenance Program Reliability Program (engines); aircraft maintenance program & their approval; on condition maintenance of reciprocating engines; TBO revision program; maintenance of fuel and oil uplift and consumption records light aircraft engines; fixing routine maintenance periods.

UNIT III C.A.R. SERIES E: APPROVAL OF ORGANISATIONS 9

Approval of organizations in categories A,B,C,D,E,F,&G Requirements of infrastructure at stations other than parent base. C.A.R. Series F 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 C.A.R. SERIES :L - M 9

Issue of AME License, its classification and experience requirements, Mandatory Modifications / Inspections

UNIT V C.A.R. SERIES T:X 9

Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C of A had been aid kits previously issued. Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first & 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 PERIODS 45

COURSE OUTCOMES

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

- demonstrate the necessity, scope and provisions of civil aviation rules for safer operation.

- elaborate the procedures for acquiring approval to run the airline organizations.
- analyze the documents related to airworthiness certification for continued operation.
- classify the various Aeronautical organization standards and regulations.
- develop the certification standards and licensing standards

TEXT BOOKS

1. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 7 AAI, 2000 and 2006
2. Aircraft Manual (India) Volume Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

REFERENCES

1. Advisory Circulars from DGCA 2003 & 2010.
2. Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness) - Published by DGCA, The English Book Store, 17- 1,Connaught Circus, New Delhi 2000.

WEB LINKS

1. http://nptel.ac.in/course.php
2. http://dgca.nic.in/rules/car-ind.htm

Mapping of Course Outcomes with Program Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	3	3	2	-	3	-	-	-	-	2	3	3
CO2	-	2	2	3	3	-	2	-	-	-	-	2	3	2
CO3	-	2	3	3	2	-	2	-	-	-	-	2	2	3
CO4	-	3	2	2	3	-	3	-	-	-	-	2	2	2
CO5	-	3	3	2	3	-	3	-	-	-	-	2	3	2

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Aeronautical Engineering
AUTONOMOUS

AE15252 **HELICOPTER MAINTENANCE** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of helicopter
- understand the rotor system and maintenance
- learn the transmission and maintenance
- study about the different type of power plants
- build up necessary knowledge on structure maintenance

UNIT I HELICOPTER FUNDAMENTALS **9**

Basic directions -ground handling, bearing -gears construction -Construction of fuselage and tail Structures

UNIT II MAIN ROTOR SYSTEM **9**

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 - mast & flight control rotor - mast- stabilizer, dampeners - swash plate flight control systems collective - cyclic - push pull tubes -torque tubes- bell cranks - mixer box -gradient unit control boosts - maintenance & inspection control rigging

UNIT III MAIN ROTOR TRANSMISSIONS **9**

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 AND TAIL ROTORS **9**

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**

Fuselage and tail structures maintenance-Gust effect on Tail rotor structures-Safety on In and Around Helicopter

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- elaborate the basic maintenance in helicopter
- analyze the rotor assembly and maintenance
- exhibit the transmission in rotor
- classify the various types of power plant
- demonstrate the helicopter structure and safety

TEXT BOOKS

1. U.S Department of Transportation, FAA - Basic helicopter handbook - 2013.
2. Jeppesen, "Helicopter Maintenance", Jeppesons and Sons Inc., 2000.

REFERENCES

1. U.S department of Transportation, FAA, Airframe and power plant mechanics, 2008.
2. "Civil Aircraft Inspection Procedures - Part I & II", CAA, English Book House - Delhi, 1986.
3. Larry Reithmier, "Aircraft Repair Manual", Palamar Books Marquette, 2002.

WEB LINKS

1. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/helicopter_flying_handbook
2. http://www.helicoptermaintenancemagazine.com/

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												PSOs	
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CO1	3	2	2	3	2	-	2	-	2	-	-	2	3	3
CO2	2	3	2	3	2	-	2	-	-	-	-	3	3	2
CO3	-	2	3	2	3	-	3	-	3	-	-	2	2	3
CO4	3	2	3	2	3	-	2	-	3	-	-	2	2	2
CO5	2	1	3	3	2	-	3	-	2	-	-	2	3	2

AE15253 AERO ENGINE REPAIR AND MAINTENANCE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study about the various classification of piston engines
- know about the inspection procedures applicable for piston engines
- understand the use of tools and instruments for inspection of piston engines
- gain knowledge about the Jet engine components
- introduce the overhauling processes involved in Jet engine

UNIT I CLASSIFICATION OF PISTON ENGINE COMPONENTS 9

Types of piston engines – principles of operation – function of components – materials used – details of starting the engines – details of carburetion and injection systems for small and large engines – ignition system components – spark plug details – engine operation conditions at various altitudes – maintenance and inspection check to be carried out.

UNIT II INSPECTION OF PISTON ENGINES 9

Inspection and maintenance and troubleshooting – inspection of all engine components – daily and routine checks – overhaul procedures – compression testing of cylinders – special inspection schedules – engine fuel, control and exhaust systems – engine mount and super charger – checks and inspection procedures.

UNIT III TOOLS AND INSTRUMENTS FOR INSPECTION OF PISTON ENGINES 9

Symptoms of failure – fault diagnostics – case studies of different engine systems – 1: tools and equipment requirements for various checks and alignment during overhauling – tools for inspection – tools for safety and for visual inspection – methods and instruments for non destructive testing techniques – equipments for replacement of part and their repair. Engine testing: engine testing procedures and schedule preparation – online maintenance.

UNIT IV CLASSIFICATION OF JET ENGINE COMPONENTS 9

12 types of jet engines – principles of operation – materials used – details of starting and operation procedures – gas turbine engine inspection & checks – use of instruments for online maintenance – special inspection procedures: foreign object damage -blade damage – etc. Maintenance procedure of gas turbine engines – trouble shooting and rectification procedures – component maintenance procedures – systems maintenance procedures. Gas turbine testing procedures – test schedule preparation – storage of engines – preservation and depreservation procedures.

UNIT V OVERHAULING 9

Engine Overhaul - Overhaul procedures - Inspections and cleaning of components – Repairs schedules for overhaul - Balancing of Gas turbine components. Trouble Shooting: Procedures for trouble shooting - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the components and functions of piston Engine
- carry out the inspection in piston engine
- identify the tools and instruments applicable for maintenance of piston engines
- determine the various parts and functions of jet engine in an aircraft

- perform the overhauling procedures followed for Jet engine

TEXT BOOKS

1. Krores and Wild, "Aircraft Power plants", 7th edition – TATA McGraw Hill,New Delhi, 2010.
2. Turbomeca, "Gas Turbine Engines", The English Book Store, New Delhi, 1993.

REFERENCES

1. United Technologies' Pratt and Whitney, "The Aircraft Gas turbine engine and its Operation", (latest edition) The English Store, New Delhi, 2005.
2. Treager, Aircraft: "Gas Turbine Engine Technology", Tata McGraw-Hill, 2002
3. Ralph .D. Bent, James .L. McKinsley, "Aircraft & Powerplants", Gregg Division, McGraw Hill, 1985
4. Dale Crane, "Aviation Maintenance Technician: Powerplants," 2nd edition, Aviation Supplies & Academics Inc,2005

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CO3	-	2	3	2	3	-	3	-	3	-	-	2	2	3
CO4	3	2	3	2	3	-	2	-	3	-	-	2	2	2
CO5	2	1	3	3	2	-	3	-	2	-	-	2	3	2

AE15254 AIRFRAME MAINTENANCE AND REPAIR 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- build up necessary background for understanding welding in aircraft structural components
- understand the uses of plastics and composites in aircraft
- learn the objective and target of airplane jacking and weighing and C.G. location.
- introduce the trouble shooting and maintenance practices
- study various hazardous materials storage and handling

UNIT I WELDING IN AIRCRAFT STRUCTURAL COMPONENTS 9

Equipment's used in welding shop and their maintenance ensuring quality welds welding jigs and fixtures soldering and brazing

UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT 9

Review of types of plastics used in airplanes maintenance and repair of plastic components repair of cracks, holes etc., and various repair schemes scopes. Inspection and repair of composite components special precautions autoclaves. Inspection of damage classification repair or replacement sheet metal inspection N.D.T. Testing riveted repair design, damage investigation

UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING 9

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM 9

Trouble shooting and maintenance practices service and inspection. inspection and maintenance of landing gear systems. inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of instruments handling testing inspection. Inspection and maintenance of auxiliary systems fire protection systems ice protection system rain removal system position and warning system auxiliary power units (APUs).

UNIT V SAFETY PRACTICES 9

Hazardous materials storage and handling, aircraft furnishing practices equipment's. Trouble shooting - theory and practices

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the scope and provisions in welding in aircraft structural components
- elaborate the procedures for acquiring plastics and composites in aircraft
- analyze the airplane jacking and weighing operations.
- demonstrate about the various Trouble shooting and maintenance practices
- handle the hazardous materials storage

TEXT BOOKS

1. Kroes, Watkins, Delp, "Aircraft Maintenance and Repair", Tata McGraw-Hill, New Delhi,2010
2. McKinley.L and R. D. Bent, "Aircraft Maintenance & Repair", Tata McGraw-Hill, 2010.

REFERENCES

1. General Hand Books of Airframe and Powerplant Mechanics, U. S. Dept. of Transportation, Federal Aviation Administration, the English Book Store, New Delhi 2006.
2. Larry Reithmeir, "Aircraft Repair Manual", Palamar Books, Marquette, 2007.
3. Brim D.J.andBogges H.E., "Aircraft Maintenance", Pitman Publishing.

WEB LINKS

1. https://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_airframe_handbook
2. http://www.jdrr.yolasite.com/aeronautical.php

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CO2	1	3	2	2	2	-	-	-	1	2	-	1	2	3
CO3	2	2	2	3	1	-	-	-	-	-	-	3	2	3
CO4	3	2	3	3	2	-	-	-	-	-	-	3	2	3
CO5	3	2	1	2	2	-	-	-	-	-	-	3	3	3