SEMESTER III

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA20301	Transforms and Boundary Value Problems	3	1	0	4
2	PC	AE20301	Basics of Aeronautical Engineering	3	0	0	3
3	ES	AE20302	Fluid Mechanics and Machinery	3	0	0	3
4	ES	AE20303	Solid Mechanics and Basics of Aircraft Structures	3	0	0	3
5	PC	AE20304	Aero Engineering Thermodynamics	3	0	0	3
6	MC	MC20301	Value Education	2	0	0	0
Practical							
7	ES	AE20305	Fluid Mechanics and Machinery Laboratory	0	0	2	1
8	ES	AE20306	Strength of Materials Laboratory	0	0	2	1
9	PC	AE20307	Thermodynamics Laboratory	0	0	2	1
			Total	**17**	**1**	**6**	**19**

SEMESTER IV

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA20404	Numerical Methods	3	1	0	4
2	PC	AE20401	Aerodynamics I	3	0	0	3
3	PC	AE20402	Aircraft Propulsion	3	1	0	4
4	PC	AE20403	Aircraft Structures I	3	1	0	4
5	PC	AE20404	Aircraft Systems and Instruments	3	0	0	3
6	PC	AE20405	Aircraft Materials	3	0	0	3
Practical							
7	PC	AE20406	Aerodynamics Laboratory	0	0	2	1
8	PC	AE20407	Aircraft Structures I Laboratory	0	0	2	1
9	EE	EN20401	English Proficiency Course Laboratory	0	0	2	1
			Total	**18**	**3**	**6**	**24**

SEMESTER III

MA20301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 1 0 4

COURSE OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES **12**

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II FOURIER TRANSFORMS **12**

Fourier integral theorem (without proof); Fourier transform pair; Convolution theorem; Parseval's identity; Sine and Cosine transforms; Properties; Transforms of elementary functions.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations ; Lagrange's linear equation ; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS **12**

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS **12**

Z-transforms; Elementary properties; Inverse Z-transform; Convolution theorem; Formation of difference equations; Solution of difference equations using Z-transform.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- derive Fourier series, their possible forms of representations of periodic functions
- identify and formulate a function in frequency domain whenever the function is defined in time domain
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation.

TEXT BOOKS

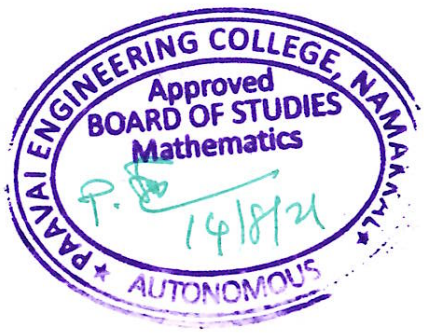
1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).

REFERENCES

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Enginears", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
5. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition,Wiley Publications.

CO - PO Mapping

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



AE20301 BASICS OF AERONAUTICAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the historical evaluation of aircraft and its component
- study the different forces acting on a aircraft
- understand the basic mechanism of flight
- study the various types of power plant used in aircrafts and rocket
- gain knowledge about space mechanics

UNIT I INTRODUCTION TO AIRCRAFTS 7

Evolution and history of flight; types of aerospace industry; advances in engineering/ CAD/CAM/CAE tools and materials technology; Basic components of an aircraft - structural members, control surfaces and high lift devices. Types of aircrafts - canard layout, span loaders, blended body wing layout, advantages and disadvantages of STOL, VTOL and stealth aircraft.

UNIT II PRINCIPLES OF FLIGHT 10

Properties of atmosphere, Bernoulli's equation; Forces on the airplane - Generation of lift, drag, types of drag, Lift curve, Drag curve, lift/drag ration curve; Factors affecting lift and drag; Center of pressure and its effects.

UNIT III BASICS OF FLIGHT MECHANICS 9

Mach waves; Mach angles; Sonic and supersonic flight and its effects; Aircraft axis system; Degrees of stability - Lateral, Longitudinal and directional stability and controls of aircraft; Stalling; Landing; Gliding; Turning; Speed of sound; Mach numbers; Shock waves.

UNIT IV POWER PLANTS 11

Basic ideas about piston; turboprop and jet engines - use of propeller and jets for thrust production, comparative merits; Principles of operation of rocket - types of rockets and typical applications; Exploration into space.

UNIT V BASICS OF SPACE MECHANICS 8

Kepler's laws; Newton's Law of gravity; Solar system; Solar eclipse; Celestial sphere; Fundamentals of orbital mechanics; Space environment (atmosphere, radiation & magnetic fields).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- discuss the history of aircraft & developments over the years
- identify the types of aircraft forces
- discuss the basic concepts of flight & Physical motion
- differentiate the propulsion systems of Aircraft and Rocket
- carry out and analyze simple calculation about space mechanics

TEXT BOOKS

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, Eighth edition , 2015
2. Kermode, A.C. "Flight without Formulae", Pearson Education, Eleventh edition, 2011

REFERENCES

1. Thomas W. Wild , "Aircraft Power Plants", McGraw Hill, Ninth edition,2018.
2. Pallet.E.H.J. "Aircraft Instruments", Pearson Education, second edition,2009.
3. Pilot's Handbook of Aeronautical Knowledge, FAA, 2016 edition
4. Richard S. Shevell, " Fundamentals of Flight ", Pearson Education, second k.k. Edition 2004

CO - PO Mapping

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

AE20302 **FLUID MECHANICS AND MACHINERY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the control volume analysis to develop basic equations and to solve problem.
- understand the boundary layer concept and boundary layer separation over the airfoil.
- learn to use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity.
- study the concept of pump and turbine.
- gain the knowledge on the flow over an airfoil

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS **9**

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.

UNIT III DIMENSIONAL ANALYSIS **9**

Need for dimensional analysis; Methods of dimensional analysis; Similitude – types of similitude; Dimensionless parameters - application of dimensionless parameters.

UNIT IV PUMPS AND TURBINES **9**

Velocity triangles; Centrifugal pumps – working principle, work done by the impeller; Hydraulic Turbines -Classification of hydraulic turbines, Working principle of Pelton wheel, Francis and Kaplan turbines; Velocity triangles; Propeller fundamentals for marine propulsion.

UNIT V BASICS OF FLOW OVER AN AIRFOIL **9**

Airfoil Nomenclature; Types of Airfoil; Wing section - Aerodynamic Center, Aspect Ratio, Effects of lift, drag speed, air density on drag; Airflow over wing section - Pressure Distribution over a wing section.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- apply mathematical knowledge to predict the properties and characteristics of a fluid.
- perform the flow analysis in circular pipes
- utilize about the concepts involved in dimensional analysis
- analyze the performance of pumps and execute the performance calculations.
- explain the properties of flow over the airfoil

TEXT BOOKS

1. F. M. White, "Fluid Mechanics", 6th Edition, Tata McGraw-Hill, New Delhi, 2008.
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. Philip J. Pritchard, "Fox and McDonald's Introduction to Fluid Mechanics", Eighth Edition, Wiley, 2011.
3. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, Revised Ninth edition
4. Munson, Bruce R., Young, Donald F., Okiishi, Theodore H., Huebsch, Wade W. "Fundamentals of FluidMechanics", Seventh Edition, John Wiley & Sons, Inc. 2016

CO - PO Mapping

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

AE20303 SOLID MECHANICS AND BASICS OF AIRCRAFT STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of stress and strain in simple and compound bars.
- understand the load transferring mechanism in beams.
- compute slopes and deflection of indeterminate beams by various methods.
- apply basic equation of simple torsion in designing of shafts and helical spring
- study the aircraft component's structure type.

UNIT I CONCEPT OF SIMPLE STRESSES AND STRAINS **10**

Concept of stress and strain - Hooke's law, Tension, Compression, and Shear, stress-strain diagram, Poisson's ratio, elastic constants and their relationship; Deformation of simple and compound bars - Principal plane, principal stress, maximum shearing stress; Uniaxial and biaxial state of stress - Mohr's circle for plane stresses.

UNIT II LOAD AND STRESSES IN BEAMS **10**

Beams - types transverse loading on beams; Shear force and bending moment in beams; Cantilevers; Simply supported beams and over - hanging beams; Bending stress in Beams; Theory of simple bending; Bendingstresses in symmetrical and unsymmetrical sections

UNIT III DEFLECTION OF BEAMS **10**

Deflection and slope of beams; Double Integration; Macaulay's methods and Conjugate method for simply supported, Cantilever Beams.

UNIT IV STRESSES IN SHAFTS, SPRINGS AND THIN PRESSURE VESSELS **8**

Torsion of Circular Shafts; Shear Stresses and Twist in Solid and Hollow Shafts; Close and open Coil Helical springs; Stresses in Thin-Walled Pressure Vessels.

UNIT V BASICS OF AIRCRAFT STRUCTURES **7**

Loads on Fuselage - Truss, Monocoque, semi monocoque and Geodesic structure; Loads on Wing - arrangement, spar configuration (I–beam spar), ribs and skin; Loads on Tail and Landing gear and their Configuration.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- find the elongation, stress, strain, Elastic constants for bars.
- calculate and draw Shear Force and Bending moment.
- calculate the slope and deflection in beams using different methods.
- determine stresses and deformation in circular shafts and helical spring due to torsion.
- explain the aircraft loads and their component structure

TEXT BOOKS

1. S. Timoshenko and D.H. Young "Elements of strength materials Vol. I and Vol. II", T. Van Nostrand Co-Inc 2003.
2. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., Sixth edition, 2015

REFERENCES

1. James M. Gere, "Mechanics of Materials", Eighth Edition, Brooks/Cole, USA, 2013.
2. Egor P. Popov., "Engineering mechanics of solids", Second edition, Pearson Education India, 2015.
3. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer 2013.
4. Parviz Ghavami, "Mechanics of Materials: An Introduction to Engineering Technology", First Edition, Springer International Publishing, 2015.

CO - PO Mapping

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

AE20304 **AERO ENGINEERING THERMODYNAMICS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand the principles and basics of thermodynamics.
- study about the various Air cycles and its applications.
- acquire the knowledge of basic propulsion system.
- study the concept of Air-conditioning and its concepts
- analyse simple heat transfer problems and jet engines

UNIT I FUNDAMENTAL LAWS OF AERO 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 flow and non-flow processes, T-S equations for entropy change; Numerical Problems

UNIT II AIR STANDARD CYCLES **9**

Otto, Diesel, Dual and Brayton cycles - P-V and T-S diagrams; Air standard efficiency - mean effective pressure; numerical problems

UNIT III BASICS OF PROPULSION SYSTEMS **9**

Application of continuity, momentum and energy equations - Standard Rankine cycle, Reheat and regeneration cycle; Isentropic flow of ideal gases through nozzles; Simple jet propulsion system; Thrust rocket motor; Specificimpulse.

UNIT IV FUNDAMENTALS OF VAPOUR POWER CYCLES **9**

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

UNIT V AIRCRAFT JET ENGINES AND HEAT TRANSFER **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the laws of thermodynamics to jet engine.
- explain the efficient cycle for jet engine.
- understand principle operation of basic propulsion system.
- describe the fundamentals of vapour power cycle
- apply the basic concepts of heat transfer to solve the various engineering problems

TEXT BOOKS

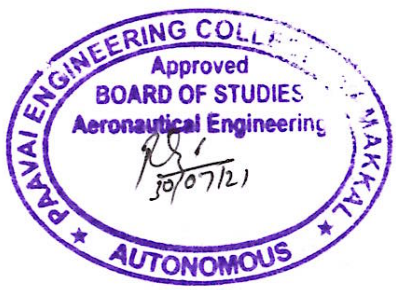
1. E.Radhakrishnan, "Fundamentals of Engineering Thermodynamics", Prentice, Hall, India, 2006
2. Nag, P. K., "Engineering Thermodynamics", 5th edition. Tata McGraw-Hill 2017.

REFERENCES

1. Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach" McGraw-Hill Science/Engineering/Math; 9th edition 2019.
2. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
3. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 2007.
4. Rayner Joel, "Basic Engineering Thermodynamics", 5th Edition, Addison Wesley, New York, 2016.

CO - PO Mapping

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



MC20301 **VALUE EDUCATION** **2 0 0 0**

COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions
- facilitate individuals think about and reflect on different values
- understand their responsibility in making choices and the practical implications of expressing them
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual

UNIT I PERSONAL VALUES **6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self –actualization, Character formation towards positive Personality, Contentment; -Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality

UNIT II SOCIAL VALUES **6**

Social Values; Pity and probity; Self control; Respect to - Age, Experience, Maturity, Family members, Neighbors; Universal Brotherhood; Flexibility; Peer pressure; Sensitization towards Gender Equality - Physically challenged, Intellectually challenged; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior; Comparison and Competition; Positive and Negative thoughts; Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS **6**

Professional Values; Knowledge thirst; Sincerity in profession - Regularity, Responsibility, Job satisfaction, Punctuality and Faith; Perseverance; Courage; Competence; Co-operation; Curbing unethical practices - Integrity, Social Consciousness and Responsibility; Global Values – Ethical values of earth centric; Computer Ethics – Moral Leadership; Code of Conduct; Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES **6**

Developing Spirituality; Thinking process; Moralization of Desires – Reduction of wants and freedom from greed; Health benefits; Physical exercises; Mental peace; Meditation - Objectives, Types, Effects on body, mind and soul; Yoga - Objectives, Types, Asanas; Family values - family's structure, function, roles, beliefs, attitudes and ideals; Family Work Ethic - Family Time, Family Traditions.

UNIT V HUMAN RIGHTS **6**

Classification of Human Rights - Right to Life, Liberty and Dignity; Right to Equality; Right against Exploitation; Cultural and Educational Rights; Physical assault and Sexual harassment; Domestic violence.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- cultivate the values needed for peaceful living in the existing society
- comprehend humanistic values to develop peace in the world
- foster ethics in profession and usage of technology
- orient with the importance of value education towards personal, group and spiritual attributes
- nurture physical, mental, spiritual growth to face the competitive world

REFERENCE BOOKS

1. Little, William, An introduction of Ethics. Allied publisher, Indian Reprint 1955
2. Sharma, S.P. Moral and Value Education; Principles and Practices, Kanishka publishers, 2013.
3. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO - PO Mapping

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

AE20305 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of venturi meter
- 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 Pelton wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

TOTAL PERIODS 30

COURSE OUTCOMES

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

- test the pitot static tube
- verify the Bernoulli's theorem
- identify the operations of pump
- analyze the problems in turbine.

CO - PO Mapping

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

AE20306 **STRENGTH OF MATERIALS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of UTM Machine
- 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 shear modulus of mild steel rod using tension test
4. Determine the young's modulus of mild steel rod 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 30

COURSE OUTCOMES

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

- test the hardness of aluminum and brass
- verify the tension of material
- identify the strength of materials using impact test
- analyze the Fatigue problem of a materials

CO - PO Mapping

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

AE20307 **THERMODYNAMICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of four and two stroke engine
- 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 and Port timing of a 4 – 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 30

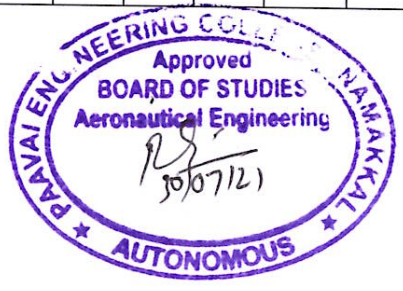
COURSE OUTCOMES

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

- test the heat exchanger
- verify the specific heat of solid
- identify the Thermal conductivity and resistance
- analyze the refrigeration and air conditioning

CO - PO Mapping

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



SEMESTER IV

MA20404 **NUMERICAL METHODS** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations
- analyse the knowledge of interpolation using numerical data
- develop the knowledge of numerical differentiation and numerical integration techniques
- solve numerically non-linear differential equations that cannot be solved by conventional analytical methods.
- apply finite difference methods of solving boundary value problems

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **12**

Solution of equation; Iteration method - Newton Raphson method; Solution of linear system by Gaussian elimination and Gauss; Jordon method; Iterative method - Gauss-Seidel method; Inverse of a matrix by Gauss Jordon method; Eigen value of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION **12**

Lagrangian Polynomials; Divided differences - Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline; Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

Differentiation using interpolation formulae; Numerical integration by trapezoidal and Simpson's 1/3; Romberg's method; Two and Three point Gaussian quadrature formulas; Double integrals using trapezoidal and Simpsons rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **12**

Single step methods - Taylor series method; Modified Euler method for first order equation; Fourth order Runge - Kutta method for solving first and second order equations; Multistep methods - Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **12**

Finite difference solution of second order ordinary differential equation; Finite difference solution of one dimensional heat equation by explicit and implicit methods; One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- comprehend the basics of algebraic and transcendental equations and their numerical solutions.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differentiation and integration in computational and

simulation processes

- utilize the numerical methods of solving initial value problems occurring in various fields of science and engineering
- describe the computational methods of solving various boundary value problems

TEXT BOOKS

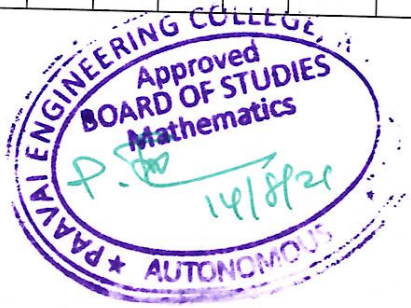
1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd Ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods for Scientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

CO - PO Mapping

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



AE20401 **AERODYNAMICS I** **3 0 0 3**

COURSE OBJECTIVES

To enable 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.
- know 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; 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 theoremand Generation of lift; D'Alembert Paradox; Magnus effect; Numerical Problems.

UNIT III CONFORMAL TRANSFORMATION **9**

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

UNIT IV AIRFOIL AND WING THEORY **9**

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 andinduced 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 the course, the students will be able to

- apply the basic equation to the aerodynamics.
- analyze and optimize the aircraft wing performance.
- utilize the dimensional analysis in two dimensions
- calculate 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., NewYork,2016
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. L. J. Clancey, "Aerodynamics", Shroff Publications, 2006.
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.
4. Ethirajan Rathakrishnan, "Theoretical Aerodynamics", 1st Edition, Wiley Publications, 2013.

CO - PO Mapping

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

AE20402 **AIRCRAFT PROPULSION** **3 1 0 4**

COURSE OBJECTIVES

To enable students to

- acquire the knowledge on basic concepts and salient features of engine components.
- 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
- gain knowledge about the working of turbines and its applications

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES **12**

Operating principles of piston engines – classification of piston engines; Classification of gas turbines – Open cycle and closed cycle turbines, efficiencies, Illustration of working of gas turbine engine; Thrust equation; Factors affecting thrust; Methods of thrust augmentation; Characteristics of turboprop, turbofan and turbojet; Numerical Problems.

UNIT II JET ENGINES INLETS **12**

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 **12**

Classification of combustion chambers; Combustion chamber performance; Effect of operating variables on performance; Flame stabilization and Flame Tube cooling ; Flow through Convergent divergent nozzles - various operating conditions, losses in nozzles, types of nozzles; Interaction of nozzle flow with adjacent surfaces; Thrust reversal; Numerical Problems

UNIT IV JET ENGINE COMPRESSORS **12**

Centrifugal compressor - Principle of operation of centrifugal compressor - work done and pressure rise; Velocity triangle; Performance characteristics; Axial flow compressor - principle of operation; Degree of reaction; Free vortex and constant reaction designs of axial flow compressor; Velocity triangle - pressure rise, performance characteristics; Compressor surging.

UNIT V JET ENGINE TURBINES **12**

Principle of operation of axial flow and radial flow turbines - limitations of radial flow turbines, Work done and pressure rise, Velocity diagrams ; Degree of reaction - Choice of blade profile, pitch and chord; Limiting factors in gas turbine design; Methods of blade cooling; Matching of turbine and compressor; Numerical problems.

TOTAL PERIODS 60

COURSE OUTCOMES

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

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

TEXT BOOKS

1. P.G. Hill and C.R. Peterson, "Mechanics & Thermodynamics of Propulsion", Addison - WesleyLongman INC, 2015.
2. Boyce, Gas Turbine Engineering Handbook, 4Th Edn, Elsevier India, 2012

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 2006.
2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2010.
3. Ganesan.V, "Gas Turbines", Third Edition, Tata McGraw-Hill, 2010.
4. Jack D. Mattingly, "Element of Propulsion- Gas turbine and rockets", AIAA Education Series,New York, 2016.

CO - PO Mapping

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

AE20403 **AIRCRAFT STRUCTURES I** **3 1 0 4**

COURSE OBJECTIVES

To enable students to

- understand the linear static analysis of determinate structure
- understand the linear static analysis of indeterminate structure
- know the energy theorem and their application
- gain the knowledge of column and their critical load
- know the failure theory on material

UNIT I STATICALLY DETERMINATE STRUCTURES **12**

Truss – types; Condition for statically determinate structure ; Analysis of plane truss; Numerical problem onMethod of joints; 3DTruss introduction; Beam - degree of indeterminacy; Types of statically determinate beam.

UNIT II STATICALLY INDETERMINATE STRUCTURES **12**

Beam - degree of indeterminacy, types of statically indeterminate beam ; Analysis - Clapeyron's Three Moment VEquation; Numerical problem for Continuous beam.

UNIT III ENERGY METHODS **12**

Strain Energy in axial, bending and torsion loading; Castigliano's theorems and their applications; Energy theorems; Numerical problems on dummy load and unit load methods.

UNIT IV COLUMNS **12**

Columns with various end conditions; Euler's Column curve; Column with initial curvature; Eccentric loading; Beam column; Numerical Problem on Rankine's formula.

UNIT V FAILURE THEORIES **12**

Maximum Stress theory; Maximum Strain Theory; Maximum Shear Stress Theory; Distortion Theory; Maximum strain energy theory ; Application to aircraft structural problems.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze statically determinate structures.
- analyze the response of statically indeterminate structures under various loading conditions.
- determine the reactions of structures using strain energy concept
- compute different numerical methods available to solve a single structural problem.
- examine the structural failures using failure theories.

TEXT BOOKS

1. Megson, T.H.G., "Aircraft Structures for Engineering Students", Fifth Edition (Rev.), Butterworth- Heinemann, 2017.
2. David J. Peery, "Aircraft Structures (Dover Books on Aeronautical Engineering)", Dover Publications,2013.

REFERENCES

1. James M. Gere & Barry J Goodno, "Mechanics of Materials", cengage Learning Custom Publishing; 9th edition, 2019
2. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", Cambridge University Press publishers,2008
3. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri– state off set Company, USA,1973
4. Timoshenko. S. and Young D.H. - "Elements of strength materials Vol. I and Vol. II"., T. Van NostrandCo-Inc Princeton-N.J. 1990.

CO - PO Mapping

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
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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

AE20404 **AIRCRAFT SYSTEMS AND INSTRUMENTS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

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

UNIT I AIRPLANE CONTROL SYSTEMS **9**

Conventional Systems; Power assisted and fully powered flight controls; Power actuated systems; Engine control systems; Push pull rod system – operating principles; Modern control systems – digital fly by wire systems, auto pilot system, Active Control Technology.

UNIT II AIRCRAFT SYSTEMS **9**

Hydraulic Systems – Types of Hydraulic oil and its properties, Components, Modes of Operation; Pneumatic Systems – Working Principles, Components; Landing Gear Systems.

UNIT III ENGINE SYSTEMS **9**

Basic Fuel System Requirements Fuel systems for Piston and jet engines; Lubricating systems for piston and jet engines; Starting system for piston engine and Ignition systems for piston engine; Full Authority Digital Engine Control (FADEC) system.

UNIT IV AIRCRAFT INSTRUMENTS **9**

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

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 the course, the 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.
- utilize the various cockpit controls.

TEXT BOOKS

1. Pallett E H J, "Aircraft Instruments – Principles and Applications", Second Edition, Longman House,1981.
2. 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, Allan Seabridge and Malcolm Jukes, "Civil Avionics Systems", Second Edition, Wiley, 2013.
3. "General Hand Book of Airframe and Power plant Mechanics", U.S.Dept. of Transportation, FederalAviation Administration, English Book Store, New Delhi, 1995.
4. David A Lambardo., "Aircraft Systems", Tata McGraw-Hill, second edition 2009.

CO - PO Mapping

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

AE20405 **AIRCRAFT MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- learn different material properties, defects and equipment, procedure to perform various destructive and non-destructive tests.
- familiarize about various strengthening and hardening mechanisms of materials.
- understand materials used in aircraft construction- Aluminium, Magnesium and Titanium, Steel, Copperalloys and Super alloys.
- learn about composites, sandwich structures and adhesives.
- understand about material characterization.

UNIT I ELEMENTS OF AEROSPACE MATERIALS **9**

Structure of solid materials; Atomic structure of materials - crystal structure, miller indices, density, packing factor ; Space lattices; X-ray diffraction; Imperfection in crystals – physical metallurgy, general requirements of materials for aerospace applications

UNIT II MECHANICAL BEHAVIOUR OF MATERIALS **9**

Linear and non linear elastic properties - Yielding, strain hardening, fracture, Bauchinger's effect; Notch effect testing and flaw detection of materials and components; Creep and fatigue ; Comparative study of metals; Ceramics plastics and composites.

UNIT III CORROSION & HEAT TREATMENT OF METALS AND ALLOYS **9**

Types of corrosion – effect of corrosion on mechanical properties, stress corrosion cracking; Corrosion resistance materials used for space vehicles heat treatment of carbon steels - aluminium alloys, magnesium alloys and titanium alloys; Effect of alloying treatment - heat resistance alloys; Tool and die steels; Magnetic alloys.

UNIT IV CERAMICS AND COMPOSITES **9**

Introduction – powder metallurgy, modern ceramic materials; Cermets; Cutting tools; Glass ceramic – production of semi fabricated forms; Plastics and rubber; Carbon/carbon composites - fabrication processes involved in metal matrix composites; Shape memory alloys – applications in aerospace vehicle design, open and close mould processes.

UNIT V HIGH TEMPERATURE MATERIALS CHARACTERIZATION **9**

Classification production and characteristics – methods and testing, determination of mechanical and thermal properties of materials at elevated temperatures; Application of these materials in thermal protection systems of aerospace vehicles; Super alloys – high temperature material characterization.

TOTAL PERIODS 45

COURSEOUTCOMES

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

- understand the mechanical behaviour of engineering materials
- understand strengthening mechanisms in materials
- gain knowledge of ferrous &non ferrous materials in aircraft
- understand composites and adhesives
- understand the basics of nano materials and material characterization

TEXT BOOKS

1. V Rajendran, "Material Science" Tata McGraw- Hill, New Delhi 2011
2. Titterton.G., Aircraft Materials and Processes, Pitman Publishing Co., 2004

REFERENCES

1. V. Raghavan, "Material Science & Engineering: A first course", Sixth Edition 2015.
2. Lalith Gupta "Advanced Composite Materials ", Himalaya Book House, Delhi, 2006
3. Marc Andre Meyers and Krishna Kumar Chawla, "Mechanical behavior of materials",Prentice-Hall, Inc. USA, 1999.
4. R. W. Hertzberg, "Deformation and Fracture Mechanics of Engineering Materials", 4th Edition, John Wiley, USA, 1996.

CO - PO Mapping

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

AE20406 **AERODYNAMICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the flow pattern around the airfoil
- 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. Calibration of a subsonic Wind tunnel.
2. Flow visualization in smoke tunnel.
3. Study of lift drag characteristics of airfoils using wind tunnel.
4. Measurement of boundary layer thickness
5. Force measurement using wind tunnel balancing set up.
6. Pressure distribution over a smooth cylinder
7. Pressure distribution over a rough circular cylinder.
8. Pressure distribution over a symmetric aerofoil.
9. Pressure distribution over a cambered aerofoil.
10. Flow visualization studies in low-speed flows over airfoil with different angle of incidence.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- test the wind tunnel
- verify the lift and drag using wind tunnel
- identify the flow pattern
- analyze the wind tunnel balance

CO - PO Mapping

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

AE20407 **AIRCRAFT STRUCTURES I LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the behavior of deflection of various beams under different 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 aluminum and steel.
2. Determination of deflection of a simply supported beam.
3. Determination of deflection of a cantilever beam.
4. Fabrication of simple composite material.
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 30

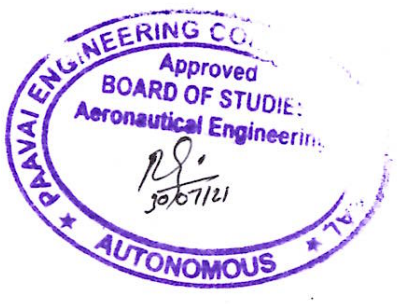
COURSE OUTCOMES

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

- calculate the deflection of beam with various end condition
- verify the reciprocal theorem
- determine the pressure points of the cylinder
- verify the superposition theorem

CO - PO Mapping

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



EN20401 ENGLISH PROFICIENCY COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- familiarize with the reading skills such as skimming and scanning.
- practice writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.

LIST OF EXPERIMENTS

1. Listening Exercises from TOEFL
   a. Conversations, Lectures
2. Listening Exercises from IELTS
   a. Places and directions
   b. Actions and processes
3. Reading Exercises from PTE
   a. Re-order paragraphs
4. Reading Exercises from IELTS
   a. Opinions and attitudes
   b. Locating and matching information
   c. Identifying information
5. Reading Exercises from BEC Vantage & BEC Higher
   a. Error identification
   b. Gap filling
6. Writing Exercises from PTE
   a. Summarize written text
7. Writing Exercises from IELTS
   a. Describing maps
   b. Describing diagrams
8. Speaking IELTS format
   a. Talking about familiar topics
   b. Giving a talk
   c. Discussion on a Topic

TOTAL PERIODS 30

COURSE OUTCOMES

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

- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.

REFERENCES

1. Cambridge University Press India Pvt.Ltd, New Delhi.2016.
2. PTE Academic Testbuilder. Macmillan Education.London. 2012.
3. Cambridge IELTS 12 Academic Student's Book with Answers: Authentic Examination Papers IELTS by Cambridge University Press . New Delhi.2016
4. TOEFL iBT Prep Plus 2018-2019 4 Practice Tests) Kaplan Publishing. Newyork.2017.

WEB LINKS

1. https://magoosh.com/toefl/2018/best-toefl-books/
2. https://ptetutorials.com/
3. http://ieltsliz.com/recent-ielts-questions-and-topics/

CO - PO Mapping

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

SEMESTER V

AE20501	FLIGHT MECHANICS	3	0	0	3

COURSE OBJECTIVES

To enable students to

- familiarize students with the cruising flight performance.
- describe the performance of flight under different maneuvering conditions.
- familiarize with various Aircraft motions and related stability.
- analyze the longitudinal, lateral, directional stability modes of an aircraft.
- familiarize with the concept of dynamic stability of Aircraft.

UNIT I PRINCIPLES OF FLIGHT **9**

Physical properties and structure of the atmosphere; International Standard Atmosphere –Temperature, pressure and altitude relationship; Measurement of speed -True, Indicated and Equivalent air speed; Streamlined and bluff bodies; Various Types of drag in airplanes - Drag polar, Methods of drag reduction of airplanes.

UNIT II AIRCRAFT PERFORMANCE IN LEVEL, CLIMBING AND GLIDING **8**

Straight and level flight; Thrust required and available- Power required and available; Effect of altitude on thrust and power; Conditions for minimum drag and minimum power required – Gliding and Climbing flight, Range and endurance.

UNIT III ACCELERATED FLIGHT **10**

Take-off and landing performance; Turning performance - horizontal and vertical turn, pull up and pull Down, maximum turn rate; V-n diagram with FAR regulations.

UNIT IV LONGITUDINAL STABILITY AND CONTROL **9**

Degrees of freedom of a system – static and dynamic stability, static longitudinal stability; Contribution of individual components – neutral point, static margin, hinge moment, elevator control effectiveness; Power effects- elevator angle to trim, elevator angle per g, maneuver point, stick force gradient, aerodynamic balancing; Aircraft equations of motion; stability derivatives; stability quartic; Phugoid motion.

UNIT V LATERAL, DIRECTIONAL STABILITY AND CONTROL **9**

Yaw and side slip; Dihedral effect; Contribution of various components - lateral control, aileron control power; Strip theory - aileron reversal, weather cock stability, directional control, rudder requirements, dorsal fin; One engine inoperative condition- Dutch roll, spiral and directional divergence, autorotation and spin.

TOTAL PERIODS: 45

SEMESTER III

MA20301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 1 0 4

COURSE OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES **12**

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II FOURIER TRANSFORMS **12**

Fourier integral theorem (without proof); Fourier transform pair; Convolution theorem; Parseval's identity; Sine and Cosine transforms; Properties; Transforms of elementary functions.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations ; Lagrange's linear equation ; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS **12**

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS **12**

Z-transforms; Elementary properties; Inverse Z-transform; Convolution theorem; Formation of difference equations; Solution of difference equations using Z-transform.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- derive Fourier series, their possible forms of representations of periodic functions
- identify and formulate a function in frequency domain whenever the function is defined in time domain
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation.

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).

REFERENCES

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Enginears", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
5. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition,Wiley Publications.

CO - PO Mapping

Mapping of Course Outcomes with Program Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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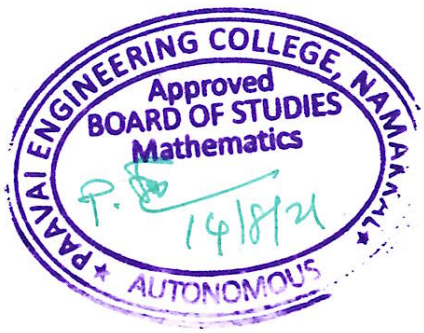
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2



AE20301 BASICS OF AERONAUTICAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the historical evaluation of aircraft and its component
- study the different forces acting on a aircraft
- understand the basic mechanism of flight
- study the various types of power plant used in aircrafts and rocket
- gain knowledge about space mechanics

UNIT I INTRODUCTION TO AIRCRAFTS 7

Evolution and history of flight; types of aerospace industry; advances in engineering/ CAD/CAM/CAE tools and materials technology; Basic components of an aircraft - structural members, control surfaces and high lift devices. Types of aircrafts - canard layout, span loaders, blended body wing layout, advantages and disadvantages of STOL, VTOL and stealth aircraft.

UNIT II PRINCIPLES OF FLIGHT 10

Properties of atmosphere, Bernoulli's equation; Forces on the airplane - Generation of lift, drag, types of drag, Lift curve, Drag curve, lift/drag ration curve; Factors affecting lift and drag; Center of pressure and its effects.

UNIT III BASICS OF FLIGHT MECHANICS 9

Mach waves; Mach angles; Sonic and supersonic flight and its effects; Aircraft axis system; Degrees of stability - Lateral, Longitudinal and directional stability and controls of aircraft; Stalling; Landing; Gliding; Turning; Speed of sound; Mach numbers; Shock waves.

UNIT IV POWER PLANTS 11

Basic ideas about piston; turboprop and jet engines - use of propeller and jets for thrust production, comparative merits; Principles of operation of rocket - types of rockets and typical applications; Exploration into space.

UNIT V BASICS OF SPACE MECHANICS 8

Kepler's laws; Newton's Law of gravity; Solar system; Solar eclipse; Celestial sphere; Fundamentals of orbital mechanics; Space environment (atmosphere, radiation & magnetic fields).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- discuss the history of aircraft & developments over the years
- identify the types of aircraft forces
- discuss the basic concepts of flight & Physical motion
- differentiate the propulsion systems of Aircraft and Rocket
- carry out and analyze simple calculation about space mechanics

TEXT BOOKS

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, Eighth edition , 2015
2. Kermode, A.C. "Flight without Formulae", Pearson Education, Eleventh edition, 2011

REFERENCES

1. Thomas W. Wild , "Aircraft Power Plants", McGraw Hill, Ninth edition,2018.
2. Pallet.E.H.J. "Aircraft Instruments", Pearson Education, second edition,2009.
3. Pilot's Handbook of Aeronautical Knowledge, FAA, 2016 edition
4. Richard S. Shevell, " Fundamentals of Flight ", Pearson Education, second k.k. Edition 2004

CO - PO Mapping

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

AE20302 **FLUID MECHANICS AND MACHINERY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the control volume analysis to develop basic equations and to solve problem.
- understand the boundary layer concept and boundary layer separation over the airfoil.
- learn to use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity.
- study the concept of pump and turbine.
- gain the knowledge on the flow over an airfoil

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS **9**

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.

UNIT III DIMENSIONAL ANALYSIS **9**

Need for dimensional analysis; Methods of dimensional analysis; Similitude – types of similitude; Dimensionless parameters - application of dimensionless parameters.

UNIT IV PUMPS AND TURBINES **9**

Velocity triangles; Centrifugal pumps – working principle, work done by the impeller; Hydraulic Turbines -Classification of hydraulic turbines, Working principle of Pelton wheel, Francis and Kaplan turbines; Velocity triangles; Propeller fundamentals for marine propulsion.

UNIT V BASICS OF FLOW OVER AN AIRFOIL **9**

Airfoil Nomenclature; Types of Airfoil; Wing section - Aerodynamic Center, Aspect Ratio, Effects of lift, drag speed, air density on drag; Airflow over wing section - Pressure Distribution over a wing section.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- apply mathematical knowledge to predict the properties and characteristics of a fluid.
- perform the flow analysis in circular pipes
- utilize about the concepts involved in dimensional analysis
- analyze the performance of pumps and execute the performance calculations.
- explain the properties of flow over the airfoil

TEXT BOOKS

1. F. M. White, "Fluid Mechanics", 6th Edition, Tata McGraw-Hill, New Delhi, 2008.
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. Philip J. Pritchard, "Fox and McDonald's Introduction to Fluid Mechanics", Eighth Edition, Wiley, 2011.
3. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, Revised Ninth edition
4. Munson, Bruce R., Young, Donald F., Okiishi, Theodore H., Huebsch, Wade W. "Fundamentals of FluidMechanics", Seventh Edition, John Wiley & Sons, Inc. 2016

CO - PO Mapping

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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

AE20303 SOLID MECHANICS AND BASICS OF AIRCRAFT STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of stress and strain in simple and compound bars.
- understand the load transferring mechanism in beams.
- compute slopes and deflection of indeterminate beams by various methods.
- apply basic equation of simple torsion in designing of shafts and helical spring
- study the aircraft component's structure type.

UNIT I CONCEPT OF SIMPLE STRESSES AND STRAINS **10**

Concept of stress and strain - Hooke's law, Tension, Compression, and Shear, stress-strain diagram, Poisson's ratio, elastic constants and their relationship; Deformation of simple and compound bars - Principal plane, principal stress, maximum shearing stress; Uniaxial and biaxial state of stress - Mohr's circle for plane stresses.

UNIT II LOAD AND STRESSES IN BEAMS **10**

Beams - types transverse loading on beams; Shear force and bending moment in beams; Cantilevers; Simply supported beams and over - hanging beams; Bending stress in Beams; Theory of simple bending; Bendingstresses in symmetrical and unsymmetrical sections

UNIT III DEFLECTION OF BEAMS **10**

Deflection and slope of beams; Double Integration; Macaulay's methods and Conjugate method for simply supported, Cantilever Beams.

UNIT IV STRESSES IN SHAFTS, SPRINGS AND THIN PRESSURE VESSELS **8**

Torsion of Circular Shafts; Shear Stresses and Twist in Solid and Hollow Shafts; Close and open Coil Helical springs; Stresses in Thin-Walled Pressure Vessels.

UNIT V BASICS OF AIRCRAFT STRUCTURES **7**

Loads on Fuselage - Truss, Monocoque, semi monocoque and Geodesic structure; Loads on Wing - arrangement, spar configuration (I–beam spar), ribs and skin; Loads on Tail and Landing gear and their Configuration.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- find the elongation, stress, strain, Elastic constants for bars.
- calculate and draw Shear Force and Bending moment.
- calculate the slope and deflection in beams using different methods.
- determine stresses and deformation in circular shafts and helical spring due to torsion.
- explain the aircraft loads and their component structure

TEXT BOOKS

1. S. Timoshenko and D.H. Young "Elements of strength materials Vol. I and Vol. II", T. Van Nostrand Co-Inc 2003.
2. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., Sixth edition, 2015

REFERENCES

1. James M. Gere, "Mechanics of Materials", Eighth Edition, Brooks/Cole, USA, 2013.
2. Egor P. Popov., "Engineering mechanics of solids", Second edition, Pearson Education India, 2015.
3. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer 2013.
4. Parviz Ghavami, "Mechanics of Materials: An Introduction to Engineering Technology", First Edition, Springer International Publishing, 2015.

CO - PO Mapping

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

AE20304 **AERO ENGINEERING THERMODYNAMICS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand the principles and basics of thermodynamics.
- study about the various Air cycles and its applications.
- acquire the knowledge of basic propulsion system.
- study the concept of Air-conditioning and its concepts
- analyse simple heat transfer problems and jet engines

UNIT I FUNDAMENTAL LAWS OF AERO 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 flow and non-flow processes, T-S equations for entropy change; Numerical Problems

UNIT II AIR STANDARD CYCLES **9**

Otto, Diesel, Dual and Brayton cycles - P-V and T-S diagrams; Air standard efficiency - mean effective pressure; numerical problems

UNIT III BASICS OF PROPULSION SYSTEMS **9**

Application of continuity, momentum and energy equations - Standard Rankine cycle, Reheat and regeneration cycle; Isentropic flow of ideal gases through nozzles; Simple jet propulsion system; Thrust rocket motor; Specificimpulse.

UNIT IV FUNDAMENTALS OF VAPOUR POWER CYCLES **9**

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

UNIT V AIRCRAFT JET ENGINES AND HEAT TRANSFER **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the laws of thermodynamics to jet engine.
- explain the efficient cycle for jet engine.
- understand principle operation of basic propulsion system.
- describe the fundamentals of vapour power cycle
- apply the basic concepts of heat transfer to solve the various engineering problems

TEXT BOOKS

1. E.Radhakrishnan, "Fundamentals of Engineering Thermodynamics", Prentice, Hall, India, 2006
2. Nag, P. K., "Engineering Thermodynamics", 5th edition. Tata McGraw-Hill 2017.

REFERENCES

1. Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach" McGraw-Hill Science/Engineering/Math; 9th edition 2019.
2. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
3. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 2007.
4. Rayner Joel, "Basic Engineering Thermodynamics", 5th Edition, Addison Wesley, New York, 2016.

CO - PO Mapping

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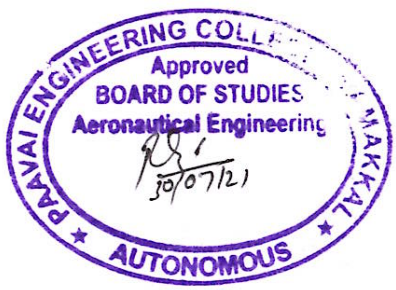
CO3	-	3	2	2	2	2	3	-	-	-	-	2	2	2
CO4	3	2	2	3	2	3	2	-	-	-	-	2	3	2
CO5	2	3	2	3	3	2	2	-	-	-	-	2	3	2



MC20301 **VALUE EDUCATION** **2 0 0 0**

COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions
- facilitate individuals think about and reflect on different values
- understand their responsibility in making choices and the practical implications of expressing them
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual

UNIT I PERSONAL VALUES **6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self –actualization, Character formation towards positive Personality, Contentment; -Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality

UNIT II SOCIAL VALUES **6**

Social Values; Pity and probity; Self control; Respect to - Age, Experience, Maturity, Family members, Neighbors; Universal Brotherhood; Flexibility; Peer pressure; Sensitization towards Gender Equality - Physically challenged, Intellectually challenged; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior; Comparison and Competition; Positive and Negative thoughts; Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS **6**

Professional Values; Knowledge thirst; Sincerity in profession - Regularity, Responsibility, Job satisfaction, Punctuality and Faith; Perseverance; Courage; Competence; Co-operation; Curbing unethical practices - Integrity, Social Consciousness and Responsibility; Global Values – Ethical values of earth centric; Computer Ethics – Moral Leadership; Code of Conduct; Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES **6**

Developing Spirituality; Thinking process; Moralization of Desires – Reduction of wants and freedom from greed; Health benefits; Physical exercises; Mental peace; Meditation - Objectives, Types, Effects on body, mind and soul; Yoga - Objectives, Types, Asanas; Family values - family's structure, function, roles, beliefs, attitudes and ideals; Family Work Ethic - Family Time, Family Traditions.

UNIT V HUMAN RIGHTS **6**

Classification of Human Rights - Right to Life, Liberty and Dignity; Right to Equality; Right against Exploitation; Cultural and Educational Rights; Physical assault and Sexual harassment; Domestic violence.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- cultivate the values needed for peaceful living in the existing society
- comprehend humanistic values to develop peace in the world
- foster ethics in profession and usage of technology
- orient with the importance of value education towards personal, group and spiritual attributes
- nurture physical, mental, spiritual growth to face the competitive world

REFERENCE BOOKS

1. Little, William, An introduction of Ethics. Allied publisher, Indian Reprint 1955
2. Sharma, S.P. Moral and Value Education; Principles and Practices, Kanishka publishers, 2013.
3. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

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

AE20305 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of venturi meter
- 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 Pelton wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

TOTAL PERIODS 30

COURSE OUTCOMES

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

- test the pitot static tube
- verify the Bernoulli's theorem
- identify the operations of pump
- analyze the problems in turbine.

CO - PO Mapping

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

AE20306 **STRENGTH OF MATERIALS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of UTM Machine
- 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 shear modulus of mild steel rod using tension test
4. Determine the young's modulus of mild steel rod 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 30

COURSE OUTCOMES

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

- test the hardness of aluminum and brass
- verify the tension of material
- identify the strength of materials using impact test
- analyze the Fatigue problem of a materials

CO - PO Mapping

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

AE20307 **THERMODYNAMICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the basic operations of four and two stroke engine
- 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 and Port timing of a 4 – 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 30

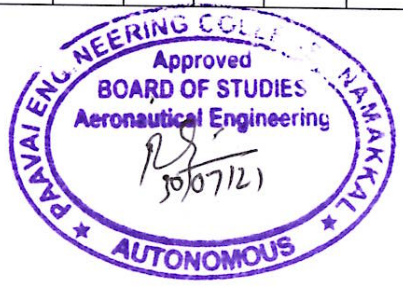
COURSE OUTCOMES

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

- test the heat exchanger
- verify the specific heat of solid
- identify the Thermal conductivity and resistance
- analyze the refrigeration and air conditioning

CO - PO Mapping

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



SEMESTER IV

MA20404 **NUMERICAL METHODS** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations
- analyse the knowledge of interpolation using numerical data
- develop the knowledge of numerical differentiation and numerical integration techniques
- solve numerically non-linear differential equations that cannot be solved by conventional analytical methods.
- apply finite difference methods of solving boundary value problems

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **12**

Solution of equation; Iteration method - Newton Raphson method; Solution of linear system by Gaussian elimination and Gauss; Jordon method; Iterative method - Gauss-Seidel method; Inverse of a matrix by Gauss Jordon method; Eigen value of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION **12**

Lagrangian Polynomials; Divided differences - Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline; Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

Differentiation using interpolation formulae; Numerical integration by trapezoidal and Simpson's 1/3; Romberg's method; Two and Three point Gaussian quadrature formulas; Double integrals using trapezoidal and Simpsons rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **12**

Single step methods - Taylor series method; Modified Euler method for first order equation; Fourth order Runge - Kutta method for solving first and second order equations; Multistep methods - Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **12**

Finite difference solution of second order ordinary differential equation; Finite difference solution of one dimensional heat equation by explicit and implicit methods; One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- comprehend the basics of algebraic and transcendental equations and their numerical solutions.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differentiation and integration in computational and

simulation processes

- utilize the numerical methods of solving initial value problems occurring in various fields of science and engineering
- describe the computational methods of solving various boundary value problems

TEXT BOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd Ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods for Scientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

CO - PO Mapping

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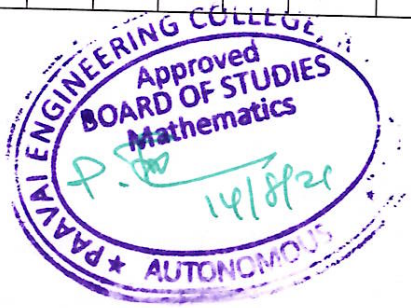
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	1	3	2



AE20401 **AERODYNAMICS I** **3 0 0 3**

COURSE OBJECTIVES

To enable 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.
- know 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; 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 theoremand Generation of lift; D'Alembert Paradox; Magnus effect; Numerical Problems.

UNIT III CONFORMAL TRANSFORMATION **9**

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

UNIT IV AIRFOIL AND WING THEORY **9**

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 andinduced 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 the course, the students will be able to

- apply the basic equation to the aerodynamics.
- analyze and optimize the aircraft wing performance.
- utilize the dimensional analysis in two dimensions
- calculate 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., NewYork,2016
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. L. J. Clancey, "Aerodynamics", Shroff Publications, 2006.
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.
4. Ethirajan Rathakrishnan, "Theoretical Aerodynamics", 1st Edition, Wiley Publications, 2013.

CO - PO Mapping

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

AE20402 **AIRCRAFT PROPULSION** **3 1 0 4**

COURSE OBJECTIVES

To enable students to

- acquire the knowledge on basic concepts and salient features of engine components.
- 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
- gain knowledge about the working of turbines and its applications

UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES **12**

Operating principles of piston engines – classification of piston engines; Classification of gas turbines – Open cycle and closed cycle turbines, efficiencies, Illustration of working of gas turbine engine; Thrust equation; Factors affecting thrust; Methods of thrust augmentation; Characteristics of turboprop, turbofan and turbojet; Numerical Problems.

UNIT II JET ENGINES INLETS **12**

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 **12**

Classification of combustion chambers; Combustion chamber performance; Effect of operating variables on performance; Flame stabilization and Flame Tube cooling ; Flow through Convergent divergent nozzles - various operating conditions, losses in nozzles, types of nozzles; Interaction of nozzle flow with adjacent surfaces; Thrust reversal; Numerical Problems

UNIT IV JET ENGINE COMPRESSORS **12**

Centrifugal compressor - Principle of operation of centrifugal compressor - work done and pressure rise; Velocity triangle; Performance characteristics; Axial flow compressor - principle of operation; Degree of reaction; Free vortex and constant reaction designs of axial flow compressor; Velocity triangle - pressure rise, performance characteristics; Compressor surging.

UNIT V JET ENGINE TURBINES **12**

Principle of operation of axial flow and radial flow turbines - limitations of radial flow turbines, Work done and pressure rise, Velocity diagrams ; Degree of reaction - Choice of blade profile, pitch and chord; Limiting factors in gas turbine design; Methods of blade cooling; Matching of turbine and compressor; Numerical problems.

TOTAL PERIODS 60

COURSE OUTCOMES

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

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

TEXT BOOKS

1. P.G. Hill and C.R. Peterson, "Mechanics & Thermodynamics of Propulsion", Addison - WesleyLongman INC, 2015.
2. Boyce, Gas Turbine Engineering Handbook, 4Th Edn, Elsevier India, 2012

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 2006.
2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2010.
3. Ganesan.V, "Gas Turbines", Third Edition, Tata McGraw-Hill, 2010.
4. Jack D. Mattingly, "Element of Propulsion- Gas turbine and rockets", AIAA Education Series,New York, 2016.

CO - PO Mapping

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

AE20403 **AIRCRAFT STRUCTURES I** **3 1 0 4**

COURSE OBJECTIVES

To enable students to

- understand the linear static analysis of determinate structure
- understand the linear static analysis of indeterminate structure
- know the energy theorem and their application
- gain the knowledge of column and their critical load
- know the failure theory on material

UNIT I STATICALLY DETERMINATE STRUCTURES **12**

Truss – types; Condition for statically determinate structure ; Analysis of plane truss; Numerical problem onMethod of joints; 3DTruss introduction; Beam - degree of indeterminacy; Types of statically determinate beam.

UNIT II STATICALLY INDETERMINATE STRUCTURES **12**

Beam - degree of indeterminacy, types of statically indeterminate beam ; Analysis - Clapeyron's Three Moment VEquation; Numerical problem for Continuous beam.

UNIT III ENERGY METHODS **12**

Strain Energy in axial, bending and torsion loading; Castigliano's theorems and their applications; Energy theorems; Numerical problems on dummy load and unit load methods.

UNIT IV COLUMNS **12**

Columns with various end conditions; Euler's Column curve; Column with initial curvature; Eccentric loading; Beam column; Numerical Problem on Rankine's formula.

UNIT V FAILURE THEORIES **12**

Maximum Stress theory; Maximum Strain Theory; Maximum Shear Stress Theory; Distortion Theory; Maximum strain energy theory ; Application to aircraft structural problems.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze statically determinate structures.
- analyze the response of statically indeterminate structures under various loading conditions.
- determine the reactions of structures using strain energy concept
- compute different numerical methods available to solve a single structural problem.
- examine the structural failures using failure theories.

TEXT BOOKS

1. Megson, T.H.G., "Aircraft Structures for Engineering Students", Fifth Edition (Rev.), Butterworth- Heinemann, 2017.
2. David J. Peery, "Aircraft Structures (Dover Books on Aeronautical Engineering)", Dover Publications,2013.

REFERENCES

1. James M. Gere & Barry J Goodno, "Mechanics of Materials", cengage Learning Custom Publishing; 9th edition, 2019
2. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", Cambridge University Press publishers,2008
3. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri– state off set Company, USA,1973
4. Timoshenko. S. and Young D.H. - "Elements of strength materials Vol. I and Vol. II"., T. Van NostrandCo-Inc Princeton-N.J. 1990.

CO - PO Mapping

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

AE20404 **AIRCRAFT SYSTEMS AND INSTRUMENTS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

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

UNIT I AIRPLANE CONTROL SYSTEMS **9**

Conventional Systems; Power assisted and fully powered flight controls; Power actuated systems; Engine control systems; Push pull rod system – operating principles; Modern control systems – digital fly by wire systems, auto pilot system, Active Control Technology.

UNIT II AIRCRAFT SYSTEMS **9**

Hydraulic Systems – Types of Hydraulic oil and its properties, Components, Modes of Operation; Pneumatic Systems – Working Principles, Components; Landing Gear Systems.

UNIT III ENGINE SYSTEMS **9**

Basic Fuel System Requirements Fuel systems for Piston and jet engines; Lubricating systems for piston and jet engines; Starting system for piston engine and Ignition systems for piston engine; Full Authority Digital Engine Control (FADEC) system.

UNIT IV AIRCRAFT INSTRUMENTS **9**

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

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 the course, the 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.
- utilize the various cockpit controls.

TEXT BOOKS

1. Pallett E H J, "Aircraft Instruments – Principles and Applications", Second Edition, Longman House,1981.
2. 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, Allan Seabridge and Malcolm Jukes, "Civil Avionics Systems", Second Edition, Wiley, 2013.
3. "General Hand Book of Airframe and Power plant Mechanics", U.S.Dept. of Transportation, FederalAviation Administration, English Book Store, New Delhi, 1995.
4. David A Lambardo., "Aircraft Systems", Tata McGraw-Hill, second edition 2009.

CO - PO Mapping

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

AE20405 **AIRCRAFT MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- learn different material properties, defects and equipment, procedure to perform various destructive and non-destructive tests.
- familiarize about various strengthening and hardening mechanisms of materials.
- understand materials used in aircraft construction- Aluminium, Magnesium and Titanium, Steel, Copperalloys and Super alloys.
- learn about composites, sandwich structures and adhesives.
- understand about material characterization.

UNIT I ELEMENTS OF AEROSPACE MATERIALS **9**

Structure of solid materials; Atomic structure of materials - crystal structure, miller indices, density, packing factor ; Space lattices; X-ray diffraction; Imperfection in crystals – physical metallurgy, general requirements of materials for aerospace applications

UNIT II MECHANICAL BEHAVIOUR OF MATERIALS **9**

Linear and non linear elastic properties - Yielding, strain hardening, fracture, Bauchinger's effect; Notch effect testing and flaw detection of materials and components; Creep and fatigue ; Comparative study of metals; Ceramics plastics and composites.

UNIT III CORROSION & HEAT TREATMENT OF METALS AND ALLOYS **9**

Types of corrosion – effect of corrosion on mechanical properties, stress corrosion cracking; Corrosion resistance materials used for space vehicles heat treatment of carbon steels - aluminium alloys, magnesium alloys and titanium alloys; Effect of alloying treatment - heat resistance alloys; Tool and die steels; Magnetic alloys.

UNIT IV CERAMICS AND COMPOSITES **9**

Introduction – powder metallurgy, modern ceramic materials; Cermets; Cutting tools; Glass ceramic – production of semi fabricated forms; Plastics and rubber; Carbon/carbon composites - fabrication processes involved in metal matrix composites; Shape memory alloys – applications in aerospace vehicle design, open and close mould processes.

UNIT V HIGH TEMPERATURE MATERIALS CHARACTERIZATION **9**

Classification production and characteristics – methods and testing, determination of mechanical and thermal properties of materials at elevated temperatures; Application of these materials in thermal protection systems of aerospace vehicles; Super alloys – high temperature material characterization.

TOTAL PERIODS 45

COURSEOUTCOMES

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

- understand the mechanical behaviour of engineering materials
- understand strengthening mechanisms in materials
- gain knowledge of ferrous &non ferrous materials in aircraft
- understand composites and adhesives
- understand the basics of nano materials and material characterization

TEXT BOOKS

1. V Rajendran, "Material Science" Tata McGraw- Hill, New Delhi 2011
2. Titterton.G., Aircraft Materials and Processes, Pitman Publishing Co., 2004

REFERENCES

1. V. Raghavan, "Material Science & Engineering: A first course", Sixth Edition 2015.
2. Lalith Gupta "Advanced Composite Materials ", Himalaya Book House, Delhi, 2006
3. Marc Andre Meyers and Krishna Kumar Chawla, "Mechanical behavior of materials",Prentice-Hall, Inc. USA, 1999.
4. R. W. Hertzberg, "Deformation and Fracture Mechanics of Engineering Materials", 4th Edition, John Wiley, USA, 1996.

CO - PO Mapping

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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

AE20406 **AERODYNAMICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the flow pattern around the airfoil
- 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. Calibration of a subsonic Wind tunnel.
2. Flow visualization in smoke tunnel.
3. Study of lift drag characteristics of airfoils using wind tunnel.
4. Measurement of boundary layer thickness
5. Force measurement using wind tunnel balancing set up.
6. Pressure distribution over a smooth cylinder
7. Pressure distribution over a rough circular cylinder.
8. Pressure distribution over a symmetric aerofoil.
9. Pressure distribution over a cambered aerofoil.
10. Flow visualization studies in low-speed flows over airfoil with different angle of incidence.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- test the wind tunnel
- verify the lift and drag using wind tunnel
- identify the flow pattern
- analyze the wind tunnel balance

CO - PO Mapping

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

AE20407 **AIRCRAFT STRUCTURES I LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- understand the behavior of deflection of various beams under different 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 aluminum and steel.
2. Determination of deflection of a simply supported beam.
3. Determination of deflection of a cantilever beam.
4. Fabrication of simple composite material.
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 30

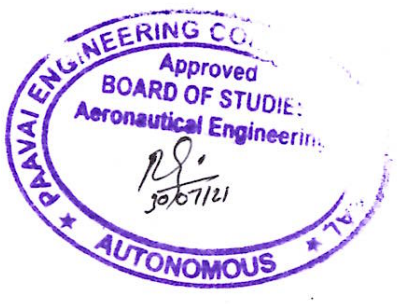
COURSE OUTCOMES

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

- calculate the deflection of beam with various end condition
- verify the reciprocal theorem
- determine the pressure points of the cylinder
- verify the superposition theorem

CO - PO Mapping

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



EN20401 ENGLISH PROFICIENCY COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- familiarize with the reading skills such as skimming and scanning.
- practice writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.

LIST OF EXPERIMENTS

1. Listening Exercises from TOEFL
   a. Conversations, Lectures
2. Listening Exercises from IELTS
   a. Places and directions
   b. Actions and processes
3. Reading Exercises from PTE
   a. Re-order paragraphs
4. Reading Exercises from IELTS
   a. Opinions and attitudes
   b. Locating and matching information
   c. Identifying information
5. Reading Exercises from BEC Vantage & BEC Higher
   a. Error identification
   b. Gap filling
6. Writing Exercises from PTE
   a. Summarize written text
7. Writing Exercises from IELTS
   a. Describing maps
   b. Describing diagrams
8. Speaking IELTS format
   a. Talking about familiar topics
   b. Giving a talk
   c. Discussion on a Topic

TOTAL PERIODS 30

COURSE OUTCOMES

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

- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.

REFERENCES

1. Cambridge University Press India Pvt.Ltd, New Delhi.2016.
2. PTE Academic Testbuilder. Macmillan Education.London. 2012.
3. Cambridge IELTS 12 Academic Student's Book with Answers: Authentic Examination Papers IELTS by Cambridge University Press . New Delhi.2016
4. TOEFL iBT Prep Plus 2018-2019 4 Practice Tests) Kaplan Publishing. Newyork.2017.

WEB LINKS

1. https://magoosh.com/toefl/2018/best-toefl-books/
2. https://ptetutorials.com/
3. http://ieltsliz.com/recent-ielts-questions-and-topics/

CO - PO Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	3	-	-	-	3	2	-	-	-	2
CO2	-	-	2	2	-	-	1	1	3	2	-	2	-	2
CO3	-	-	-	-	-	3	1	2	3	2	2	3	2	-
CO4	-	-	-	-	-	2	2	3	3	2	2	-	2	-

SEMESTER V

AE20501	FLIGHT MECHANICS	3	0	0	3

COURSE OBJECTIVES

To enable students to

- familiarize students with the cruising flight performance.
- describe the performance of flight under different maneuvering conditions.
- familiarize with various Aircraft motions and related stability.
- analyze the longitudinal, lateral, directional stability modes of an aircraft.
- familiarize with the concept of dynamic stability of Aircraft.

UNIT I PRINCIPLES OF FLIGHT **9**

Physical properties and structure of the atmosphere; International Standard Atmosphere –Temperature, pressure and altitude relationship; Measurement of speed -True, Indicated and Equivalent air speed; Streamlined and bluff bodies; Various Types of drag in airplanes - Drag polar, Methods of drag reduction of airplanes.

UNIT II AIRCRAFT PERFORMANCE IN LEVEL, CLIMBING AND GLIDING **8**

Straight and level flight; Thrust required and available- Power required and available; Effect of altitude on thrust and power; Conditions for minimum drag and minimum power required – Gliding and Climbing flight, Range and endurance.

UNIT III ACCELERATED FLIGHT **10**

Take-off and landing performance; Turning performance - horizontal and vertical turn, pull up and pull Down, maximum turn rate; V-n diagram with FAR regulations.

UNIT IV LONGITUDINAL STABILITY AND CONTROL **9**

Degrees of freedom of a system – static and dynamic stability, static longitudinal stability; Contribution of individual components – neutral point, static margin, hinge moment, elevator control effectiveness; Power effects- elevator angle to trim, elevator angle per g, maneuver point, stick force gradient, aerodynamic balancing; Aircraft equations of motion; stability derivatives; stability quartic; Phugoid motion.

UNIT V LATERAL, DIRECTIONAL STABILITY AND CONTROL **9**

Yaw and side slip; Dihedral effect; Contribution of various components - lateral control, aileron control power; Strip theory - aileron reversal, weather cock stability, directional control, rudder requirements, dorsal fin; One engine inoperative condition- Dutch roll, spiral and directional divergence, autorotation and spin.

TOTAL PERIODS: 45