PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
(AUTONOMOUS)
B.E- AERONAUTICAL ENGINEERRING
CURRICULUM-REGULATIONS 2019
(CHOICE BASED CREDIT SYSTEM)
(For the candidates admitted during the Academic Year 2019-2020 onwards)

SEMESTER III

S.No	Category	Course Code	Course Title	Course Mode	L	T	P	C
THEORY								
1.	BS	MA19301	Transforms And Boundary Value Problems	Theory	3	1	0	4
2.	ES	AE19302	Fluid Mechanics and Machinery	Theory	3	0	0	3
3.	ES	AE19303	Solid Mechanics and Basics of Aircraft Structures	Theory	3	0	0	3
4.	PC	AE19301	Basics of Aeronautical Engineering	Theory	3	0	0	3
5.	PC	AE19304	Aero Engineering Thermodynamics	Theory	3	0	0	3
6.	MC	MC19301	Value Education	Theory	2	0	0	0
PRACTICAL								
7.	ES	AE19305	Fluid Mechanics and Machinery Laboratory	Practical	0	0	2	1
8.	ES	AE19306	Strength of Materials Laboratory	Practical	0	0	2	1
9.	PC	AE19307	Thermodynamics Laboratory	Practical	0	0	2	1
				TOTAL	**17**	**1**	**6**	**19**

SEMESTER IV

S.No	Category	Course Code	Course Title	Course Mode	L	T	P	C
THEORY								
1.	BS	MA19404	Numerical Methods	Theory	3	1	0	4
2.	PC	AE19401	Aerodynamics I	Theory	3	0	0	3
3.	PC	AE19402	Aircraft Propulsion	Theory	3	1	0	4
4.	PC	AE19403	Aircraft Structures I	Theory	3	1	0	4
5.	PC	AE19404	Aircraft Systems and Instruments	Theory	3	0	0	3
6.	MC	MC19401	Environmental Science and Engineering	Theory	3	MC		
PRACTICAL								
7.	PC	AE19405	Aerodynamics Laboratory	Practical	0	0	2	1
8.	PC	AE19406	Aircraft Structures Laboratory - I	Practical	0	0	2	1
9.	EE	EN19401	English Proficiency Course Laboratory	Practical	0	0	2	1
				TOTAL	**18**	**3**	**6**	**21**

SEMESTER III

MA19301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 1 0 4

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

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 Engineers", 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.2015

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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

AE19301 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 principles of flight
- study the various types of power plant used in aircraft and rocket
- gain knowledge about space mechanics

UNIT I INTRODUCTION TO AIRCRAFT 8

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 aircraft, canard layout, span loaders, blended body wing layout, advantages and disadvantages of STOL, VTOL and stealth aircraft

UNIT II PRINCIPLES OF FLIGHT 9

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, and shock waves.

UNIT IV POWER PLANTS 10

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 9

Kepler's laws, Newton's Law of Gravity, Solar System, solar eclipse-celestial sphere. Fundamentals of orbital mechanics, Space environment (atmosphere, radiation & magnetic fields). Introduction to UAV, types and applications.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare and contrast the developments over the years
- determine the forces on an aircraft
- combine the basic concepts of flight & Physical motion
- differentiate the propulsion systems of Aircraft and Rockets
- apply laws of space mechanics for orbit determination

TEXT BOOKS

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, sixth edition, 2017
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 Edition, 2004

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

AE19302 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 Bernoulli's equation, continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 8

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 8

Need for dimensional analysis, methods of dimensional analysis. Similitude, types of similitude. Dimensionless parameters, application of dimensionless parameters

UNIT IV PUMPS AND TURBINES 10

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 AIRFOILS AND WING SECTIONS 10

Airfoil nomenclature, types of airfoil, wing section, aerodynamic center, aspect Ratio, effects of lift, drag speed, air density on drag. Airflow over 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.
- determine the properties of flow over an airfoil

TEXT BOOKS

1. White F.M, "Fluid Mechanics", Eighth Edition, Tata McGraw-Hill, New Delhi, 2017.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2017.

REFERENCES

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2017
2. Philip J. Pritchard, "Fox and McDonald's Introduction to Fluid Mechanics",Eighth Edition, Wiley, 2016.
3. Bansal R.K, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, Revised Ninth edition 2018.
4. Munson, Bruce R., Young, Donald F., Okiishi, Theodore H., Huebsch, Wade W. "Fundamentals of Fluid Mechanics", Seventh Edition, John Wiley & Sons, Inc. 2016

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

AE19303 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.
- gain the knowledge of slopes and deflection of indeterminate beams by various methods.
- comprehend the role of torsion in designing shafts and helical springs
- study the aircraft components structure type.

UNIT I CONCEPT OF SIMPLE STRESSES AND STRAINS 9

Concept of stresses and strains, Hooke's law, deformation of simple and compound bars, thermal stresses, Study of Stress-strain curves of different materials, Elastic constants and their relationship. Principal stresses and strains, Oblique sections, Mohr's circle for plane stresses.

UNIT II LOAD AND STRESSES IN BEAMS 9

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, bending stresses in symmetrical 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 9

Loads on Fuselage: truss, monocoque, semi monocoque and geodesic structure. Loads on Wing arrangement, spar configuration (I–beam spar), ribs and skin. Definition of column, types of column. Loads on tail and landing gear and their Configuration. Moment of inertia-area moment of inertia, mass moment of inertia and principal moment of inertia.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- obtain 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.
- determine the aircraft loads and their component structure

TEXT BOOKS

1. Timoshenko.S 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, 2018

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

AE19304 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 vapour power cycles and 1D flow
- study the concept of Air-conditioning and refrigeration
- understand the basic heat transfer mechanisms and jet engine performance parameters

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 BASIC PROPULSION SYSTEM 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, Specific impulse.

UNIT IV AIR CONDITIONING 9

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

UNIT V AIRCRAFT JET ENGINES AND HEAT TRANSFER 9

Classification of jet engines, ideal and non- ideal cycle analysis, Specific thrust, SFC, TSFC, isentropic efficiencies of jet engine components, polytropic efficiency, Types of heat transfer, free convection-forced convection, 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.
- evaluate the efficient cycle for jet engine.
- understand principle operation of basic propulsion system.
- judge the fundamentals of vapour power cycle
- apply the basic concepts of heat transfer to solve the various engineering problems

TEXT BOOKS

1. Radhakrishnan E, "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 Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	2
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	3	2

MC19301 **VALUE EDUCATION** 2 0 0 0

COURSE OBJECTIVES

To enable 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 COMMUNAL 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, Punctuality and Faith - Perseverance - Courage - Competence - Co-operation- Curbing unethical practices - Integrity, Social Consciousness and Responsibility. Global Values - Computer Ethics – Moral Leadership - Code of Conduct - Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES 6

Developing Spirituality - Thinking process, Moralization of Desires - 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 this 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.

TEXT BOOKS

1. Sharma, S.P. Moral and Value Education; Principles and Practices, Kanishka publishers, 2013.

REFERENCES

1. Little, William, An introduction of Ethics. Allied publisher, Indian Reprint 1955.
2. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	-	-	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	-	-

AE19305 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand the Bernoulli's theorem
- understand the procedure for estimation of performance of pumps and turbines
- gain the knowledge of Heleshaw apparatus
- gain the knowledge of viscosity of fluid

LIST OF EXPERIMENTS

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

TOTAL PERIODS 30

COURSE OUTCOMES

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

- verify the Bernoulli's theorem
- estimate the performance of pumps and turbines
- utilize the Heleshaw apparatus to identify the flow pattern
- calculate the viscosity of the fluid

CO - PO Mapping

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

AE19306 **STRENGTH OF MATERIALS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on tensile testing of materials
- familiarize the students with impact testing methodology for materials
- gain knowledge on fatigue testing method
- understand the procedure for block compression testing

LIST OF EXPERIMENTS

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

TOTAL PERIODS 30

COURSE OUTCOMES

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

- analyse the elongation and contraction of the material
- utilize the chorpy and izod impact test apparatus to determine the impact stress of the material
- analyze the Fatigue problem of a materials
- estimate the compressive stress of the material

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

AE19307 **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
- acquire the knowledge about the thermal resistance

LIST OF EXPERIMENTS

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

- examine the heat exchanger
- verify the specific heat of a solid material
- analyze the air conditioning
- determine the Thermal resistance

CO - PO Mapping

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

SEMESTER IV

MA19404 **NUMERICAL METHODS** **3 1 0 4**

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, Gauss-Seidel method, Inverse of a matrix by Gauss Jordon method; Eigenvalue 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, 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

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
- comprehend the basics of algebraic and transcendental equations and their numerical solutions.

TEXT BOOKS

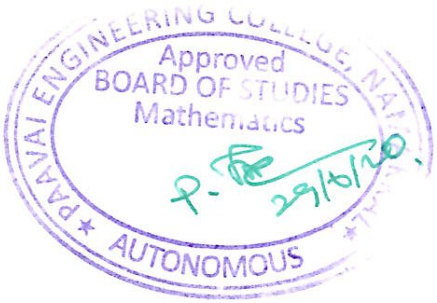
1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd Edition. Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods For Scientists And Engineers, 3rd Edition Princtice 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 Programme 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



AE19401 **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.
- familiarize the fundamentals of airfoil and wing theories and their applications
- learn boundary layer theory and its applications

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 theorem and 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 and induced drag, Helmholtz theorems, Lifting line theory and its limitations.

UNIT V INTRODUCTION TO BOUNDARY LAYER THEORY 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply conservation laws for airflow problems and their solutions.
- determine aircraft wing aerodynamic performance.

- apply Joukowski transformation to fluid flow problems.
- calculate aerodynamic characteristics of wing and airfoil
- apply boundary layer theory for estimation of skin friction drag

TEXT BOOKS

1. Anderson, J.D., "Fundamentals of Aerodynamics", Fifth Edition, McGraw-Hill Book Co., New York, 2012.
2. Houghton E L, P. W. Carpenter, Steven H. Collicott, and Daniel T. Valentine, "Aerodynamics for Engineering Students", Seventh Edition, Butterworth-Heinemann, 2016.

REFERENCES

1. Clancy, L.J., "Aerodynamics", Himlayan Books, 2010.
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.

CO - PO Mapping

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

AE19402 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 operating principle of jet propulsion method
- 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

Classification of gas turbines: Open cycle and closed cycle turbines, efficiencies, Illustration of working of gas turbine engine, The thrust equation, Factors affecting thrust, effect of pressure temperature and velocity on 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 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.

UNIT IV 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 V JET ENGINE TURBINES 12

Principle of operation of axial flow turbines, Limitations of radial flow turbines, Work done and pressure rise, Velocity diagrams, Degree of reaction, 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

- determine aircraft engine performance parameters.
- calculate diffuser performance in terms of geometrical and operational parameters
- apply combustion mechanism principles to determine combustion chamber performance
- determine performance characteristics of compressors
- calculate performance characteristics of turbines

TEXT BOOKS

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", seventh edition Longman, 2017.
2. Meherwan Boyce, "Gas Turbine Engineering Handbook", 4th Edition, Elsevier, 2011

REFERENCES

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 2009.
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.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

AE19403 AIRCRAFT STRUCTURES I 3 1 0 4

COURSE OBJECTIVES

To enable students to

- understand the linear static analysis of determinate structures
- familiarize with the linear static analysis of indeterminate structure
- learn energy theorem and its application
- learn structural behavior of columns under different loading conditions
- understand failure theory of materials

UNIT I STATICALLY DETERMINATE STRUCTURES 12

Truss: Types, condition for statically determinate structure, analysis of plane truss, numerical problem on Method 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 Equation, numerical problem for continuous beam

UNIT III ENERGY METHODS 12

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

UNIT IV COLUMNS 12

Derivation: Columns with various end conditions, Euler's column curve, column with initial curvature, Eccentric loading, and 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

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
- apply different numerical methods for the solution of aircraft structural problems
- determine 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, second edition , 2008
3. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri– state off set Company, USA, 2015.
4. Timoshenko. S. and Young D.H. - "Elements of strength materials Vol. I and Vol. II"., T. Van Nostrand Co-Inc Princeton-N.J. 1990.

CO - PO Mapping

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

AE19404 **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 and landing gear systems.

UNIT III ENGINE SYSTEMS **9**

Basic Fuel System Requirements, Fuel system 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 **10**

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

UNIT V COCKPIT LAYOUT **8**

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

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

- compare the features of various flight control systems.
- examine the principle and working of different aircraft systems.
- analyze the performance of various aircraft engine systems.

- interpret data acquired by basic aircraft instruments
- acquire knowledge on the cockpit control systems

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, 2017.

REFERENCES

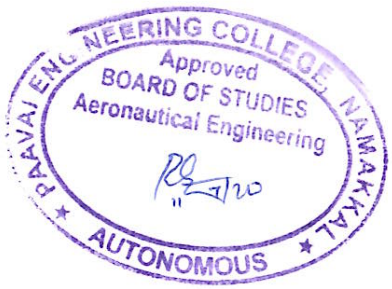
1. James Powell, "Aircraft Radio Systems", Shroff Publishers, 2006.
2. Ian Moir, Allan Seabridge and Malcolm Jukes, "Civil Avionics Systems", Second Edition, Wiley, 2013.
3. "General Hand Book of Airframe and Power plant Mechanics", U.S.Dept. of Transportation, Federal Aviation Administration, English Book Store, New Delhi, 1995.
4. David A Lambardo., "Aircraft Systems", Tata McGraw-Hill, second edition 2012.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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



MC19401 **ENVIRONMENTAL SCIENCE AND ENGINEERING** 3 0 0 0

(Mandatory, Non credit Course)

COURSE OBJECTIVES

To enable the students to

- recognize the interdisciplinary and holistic nature of the environment.
- create awareness on ecosystem and biodiversity preserve.
- study about the integrated themes of pollution control and waste management.
- understand the significance of natural resources and environment to stimulate sustainable development.
- assess the socio-economic, political and ethical issues on population with environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment–Definition, scope, importance, need for public awareness; Forest resources–Use, over exploitation, deforestation, effects on forests and tribal people; Water resources – Use, over utilization of surface and ground water.; Mineral resources – Use, exploitation, environmental effects of extracting and using mineral resources; Food resources: Effects of modern agriculture – fertilizer, pesticide problems; Role of an individual in conservation of natural resources; Activity– Slogan making event on conserving natural resources or plantation of trees.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem–Structure and function of an ecosystem, producers, Consumers, decomposers, energy flow in the ecosystem; Ecological succession; Food chains - food webs and ecological pyramids; Ecosystems–Types of ecosystem, Introduction, forest ecosystem. aquatic ecosystems(lakes, rivers); Biodiversity– Introduction, definition (genetic - species –ecosystem); Diversity–Value of biodiversity, Consumptive use, productive use, social values, ethical values, aesthetic values; Hotspots of biodiversity; Conservation of biodiversity– In-situ and ex-situ; conservation of biodiversity.

UNIT III POLLUTION 9

Pollution–Définition, air pollution, water pollution, marine pollution, noise pollution, thermal pollution ; Solid waste management– Causes, effects, control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Disaster management– Floods, earthquake, cyclone, landslides; Electronic waste –Sources, causes and its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

Water conservation – rain water harvesting, watershed management; Environmental ethics– climate change, global warming and its effects on flora and fauna, acid rain, ozone layer depletion, nuclear accidents, nuclear holocaust; Environment protection act– Air (Prevention and Control of Pollution) Act, water (Prevention and control of Pollution) act.

UNIT V HUMAN POPULATION AND ENVIRONMENT 9

Human population– Population growth, variation among nations, population explosion; Family welfare programme; Environment and human health; Human rights; Value education; HIV/AIDS; Women and child welfare; Role of information technology in environment and human health.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources.
- analyze the different types of ecosystem and biodiversity, its values and protecting the environment from degradation.
- investigate the existing environmental challenges related to pollution and its management.
- select suitable strategies for sustainable management of components of environment..
- correlate the impacts of population and human activities on environment

TEXT BOOKS

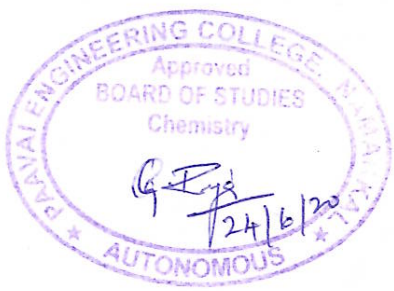
1. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2nd Edn, Tata McGraw Hill Education Private Limited, New Delhi,(2010).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, (2010).

REFERENCES

1. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2001.
2. A.K.De, Environmental Chemistry, VI edition,2015 NewAge International (P) ltd Publication, NewDelhi.
3. C.S.Rao, Environmental Pollution and Control engineering, Vedition, NewAge International (P) ltd. Publication, NewDelhi 110002
4. Clair Nathan Sawyer, Perry L. McCarty, Gene F. Parkin, "Chemistry for Environmental Engineering.

CO - PO Mapping

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



AE19405 **AERODYNAMICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- gain practical knowledge on flow pattern around airfoil
- know the procedure on the use of wind tunnel balance to determine aerodynamic forces and moments
- understand practically on pressure distribution pattern on cylinders
- gain knowledge on the use of flow visualization methods

LIST OF EXPERIMENTS

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

TOTAL PERIODS 30

COURSE OUTCOMES

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

- obtain pressure distribution around airfoil
- use and operate a wind tunnel balance
- obtain pressure distribution over a cylinder
- practically examine the air flow around bodies by flow visualization methods

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

AE19406 **AIRCRAFT STRUCTURES LABORATORY I** **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 a material.
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 Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week

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

EN19401 ENGLISH PROFICIENCY COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable 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.
- enrich their LSRW skills so as to crack on-line proficiency tests and to bring their career aspirations true.

EXERCISES FOR PRACTICE

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
5. Reading Exercises from BEC Vantage
    a. Single informational text with lexical gaps
    b. Error identification
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.
- appear with confidence for on-line tests.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	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	-
CO5	-	-	2	-	-	1	2	-	3	3	-	1	2	3