SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: BE B.Tech **Semester: VII**

Course : Aircraft Design **Course Code: 17YAS701**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	10	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite	1. Aerodynamics 2. Flight Dynamics 3. Aerospace Structure 4. Aerospace Propulsion

Course Objectives	
1	Student will enhance his knowledge on implementation of computer based aircraft design methodologies
2	Student will learn design configuration of different aeroplane parts.
3	Student will estimate the design process and sizing of aircraft
4	Student will calculate Lift and drag coefficient, design loads and component mass breakdown
5	Student will learn supersonic aircraft design concepts.

Course Content		
Unit No.	**Content**	**Hours**
1	Introduction to Aircraft Design: Three phases in aircraft design, computer based aircraft design methodologies, differences between LTA and HTA aircraft, type of civil and military aircraft.	**10**
2	Configuration and Layout: Types and comparison of wing, tail, fuselage, landing gear, wing-tail combinations, power plant (types, numbers, locations), unconventional aircraft configurations.	**10**
3	Sizing and Constraint Analysis: Initial sizing, estimation of design gross weight, rubber engine sizing and fixed engine sizing, refined sizing method and constraint analysis.	**10**

4	Estimation Methodologies: Lift and drag coefficient, design loads, component mass breakdown, acquisition cost, direct operating cost.	**10**
5	Operational and Environmental Issues: Range-payload diagram, V-n diagram, noise and emission levels, special considerations such as stealth, survivability, maintainability. Advanced Concepts in Aircraft Design: Supersonic aircraft design, very large aircraft, morphing aircraft.	**10**
	Total	**50**

Beyond the Syllabus
1. 2.

Course Outcome	
Students should able to	
CO1	Understand basic aircraft design methodologies
CO2	Evaluate the design parameters like and fixed engine sizing, refined sizing methods
CO3	Calculate Lift and drag coefficient, design loads, component mass breakdown
CO4	Understand the procedure of morphing aircraft

Recommended Resources	
Text Books	1. Raymer, D. P., Aircraft Design - A Conceptual Approach, AIAA Educational Series, 4th Ed., 2006. 2. Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R., Introduction to Aeronautics: A Design Perspective, AIAA Educational Series, 2nd ed., 2004. 3. Jenkinson, L. R., Simpkin, P. and Rhodes, D., Civil Jet Aircraft Design, Arnold Publishers, London, 1999. 4. Fielding, J., Introduction to Aircraft Design, Cambridge Aerospace Series, Cambridge University Press, 1999.
Reference Books	
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: BE B.Tech **Semester: VII**

Course : Aircraft Navigation, Guidance and Control **Course Code: 17YAS702**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	10	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.Basic electronics

Course Objectives	
1	To learn the concept of radio navigation systems
2	To study about the inertial sensors
3	To study satellite navigation & Hybrid navigation
4	To study longitudinal stability and to design the longitudinal autopilot
5	To learn about the approach and landing aids

Course Content

Unit No.	Content	Hours
1	**INERTIAL SENSORS** Gyroscopes-Mechanical-electromechanical-Ring Laser gyro- Fiber optic gyro, Accelerometers	**10**
2	**INERTIAL NAVIGATION SYSTEMS** - INS components: transfer function and errors-The earth in inertial space, the coriolis effect-Mechanisation. Platform and Strap down, INS system block diagram, Different co-ordinate systems, Schuler loop, compensation errors, Gimbal lock, Alignment.	**10**
3	**RADIO NAVIGATION –** Different types of radio navigation- ADF, VOR/DME- Doppler –LORAN, DECCA and Omega - TACAN	**14**
4	**APPROACH AND LANDING AIDS** - ILS, MLS, GLS - Ground controlled approach system - surveillance systems-radio altimeter, RNAV, Modern Navigation Aids.	**08**

5	**SATELLITE NAVIGATION & HYBRID NAVIGATION** - Introduction to GPS -system description -basic principles -position and velocity determination-signal structure-DGPS, Introduction to Kalman filtering-Estimation and mixed mode navigation-Integration of GPS and INS-utilization of navigation systems in aircraft.	**08**
	Total	**50**

Beyond the Syllabus
1.
2.

Course Outcome	
Students should able to	
CO1	Understand the working of integral sensors
CO2	Learn about the different types of radio navigation systems
CO3	Analyse satellite navigation & hybrid navigation systems.
CO4	Designing ground controlled approach systems

Recommended Resources
Text Books
Reference Books
E-Resources

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: BE B.Tech **Semester: VII**

Course : Aerospace Computational Analysis **Course Code: 17YAS703**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Theory**	**Lab**	
4	0	2	5	10	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									**End Semester Exam (Lab) - 3Hrs.**		

Prerequisite	1. Numerical Methods 2. Engineering Mathematics

Course Objectives	
1	Understand the concept of CFD and its importance.
2	Classify and understand the different PDE's.
3	Outline the types of discretization and various mesh types.
4	Understand basic concept of FVM.
5	Outline commonly used techniques in CFD.

Course Content		
Unit No.	Content	Hours
1	**Basic Aspects, Governing Equations and Physical Boundary Conditions of Computational Aerodynamics:** Why Computational Fluid Dynamics? What is CFD? CFD as a research tool- as a design tool. Applications in various branches of engineering. - Models of fluid flow- Finite Control Volume, Infinitesimal Fluid Element. Substantial derivative- physical meaning of Divergence of velocity. Derivation of continuity, momentum and energy equations- physical boundary conditions- significance of conservation and non-conservation forms and their implication on CFD applications- strong and weak conservation forms- shock capturing and shock fitting approaches.	**10**
2	**Mathematical Behavior of Partial Differential Equations and Their Impact on Computational Aerodynamics:** Classification of quasi-linear partial differential equations by Cramer's rule and eigen value method. General behaviour of different classes of partial differential	**10**

	equations and their importance in understanding physical and CFD aspects of aerodynamic problems at different Mach numbers involving hyperbolic, parabolic and elliptic equations- domain of dependence and range of influence for hyperbolic equations. Well-posed problems.	
3	**Basic Aspects of Discretization, Grid Types and Characteristics:** Introduction to finite differences- finite difference approximation for first order, second order and mixed derivatives. Pros and cons of higher order difference schemes. Difference equations- explicit and implicit approaches- truncation and round-off errors, consistency, stability, accuracy, convergence, efficiency of numerical solutions-Von Neumann stability analysis. Physical significance of CFL stability condition. Need for grid generation. Structured grids- Cartesian grids, stretched (compressed) grids, body fitted structured grids, H-mesh, C-mesh, O-mesh, I-mesh, Multi-block grids, C-H mesh, H-O-H mesh, overset grids, adaptive grids. Unstructured grids- triangular/ tetrahedral cells, hybrid grids, quadrilateral/ hexahedra cells.	**10**
4	**Finite Volume Methods:** Basis of finite volume method- conditions on the finite volume selections- cell-centered and cell-vertex approaches. Definition of finite volume discretization-general formulation of a numerical scheme- two-dimensional finite volume method with example.	**10**
5	**CFD Techniques:** Lax-Wendroff technique, MacCormack's technique-Crank Nicholson technique-Relaxation technique- aspects of numerical dissipation and dispersion. Alternating-Direction-Implicit (ADI) Technique. Pressure correction technique- application to incompressible viscous flow- need for staggered grid. Philosophy of pressure correction method-pressure correction formula. Numerical procedures- SIMPLE, SIMPLER, SIMPLEC and PISO algorithms. Boundary conditions for the pressure correction method.	**10**
	Total	50

Beyond the Syllabus
1. 2.

Course Outcome	
Students should able to	
CO1	Classify the quasil-linear PDE's as hyperbolic, elliptic or parabolic.
CO2	Describe the different approaches used in Discretization and the usage of different mesh types.
CO3	Outline the general concept of FVM.
CO4	Explain the commonly used methods in CFD analysis.

Recommended Resources	
Text Books	1. Anderson, J.D., Jr., Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill Inc., 1995. 2. Anderson, D.A., Tannehill, J.C., Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, Second Edition, Taylor and Francis, 1997.
Reference Books	1. Hirsch, C., Numerical Computation of Internal and External Flows-Fundamentals of Computational Fluid Dynamics, Second Edition, Elsevier, 2007. 2. Versteeg , H.K. and Malalasekera, W., A n In trod uc tion to Computational Fluid Dynamics-The Finite Volume Method, Second Edition, Pearson Education Ltd, 2010. 3. Tu, J., Yeoh, G.H., Liu, C., Computational Fluid Dynamics-A Practical Approach, Butterworth-Heinemann, 2008.
E-Resources	1. 2. 3.

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Rockets and Missiles **Course Code: 17YASE01**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	1	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite	1. Rocket Propulsion 2. Aerospace Structure 3. Flight Dynamics

Course Objectives	
1	Know the various systems of rocket, its functions and operations.
2	Know the working principle and System in rockets.
3	Understand the Aerodynamics of Rockets, Missiles and Airframe Components.
4	Study the Rocket Motion in Free Space and Gravitational Field.
5	Determination of range and Altitude Simple Approximations to Burnout Velocity.

Course Content		
Unit No.	**Content**	**Hours**
1	**ROCKETS SYSTEM** Ignition System in rockets - types of Igniters - Igniter Design Considerations - Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems - Propellant Slosh and Propellant Hammer, Elimination of Geysering Effect in Missiles - Combustion System of Solid Rockets.	10
2	**AERODYNAMICS OF ROCKETS AND MISSILES** Airframe Components of Rockets and Missiles - Forces Acting on a Missile While Passing Through Atmosphere - Classification of Missiles - methods of Describing Aerodynamic Forces and Moments Lateral Aerodynamic Moment - Lateral Damping Moment and Longitudinal Moment of a Rocket - lift and Drag Forces - Drag Estimation - Body Up wash and Downwash in Missiles - Rocket Dispersion Numerical Problems.	15

3	**ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD** One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields - description of Vertical, Inclined and Gravity Turn Trajectories - Determination of range and Altitude Simple Approximations to Burnout Velocity.	10
4	**STAGING AND CONTROL OF ROCKETS AND MISSILES** Rocket Vector Control - Methods - Thrust determination - SITVC - Multistaging of rockets - Vehicle Optimization - Stage Separation Dynamics - Separation Techniques.	10
5	**MATERIALS FOR ROCKETS AND MISSILES** Selection of Materials - Special Requirements of Materials to Perform under Adverse Conditions.	05
	Total	**50**

Beyond the Syllabus
3. 4.

Course Outcome	
Students should able to	
CO1	Design Consideration of liquid Rocket Combustion Chamber
CO2	Igniter Design Considerations and types of igniters. Describe the drag and lift forces acting on rocket and missile.
CO3	The various methods of Describing Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket.
CO4	The One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.
CO5	The description of Vertical and Inclined and Gravity Turn Trajectories.It will give the various methods of thrust determinations and thrust vector control. It will also describethe rocket s Separation Techniques.

Recommended Resources	
Text Books	1. Sutton, G.P., et al., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1993
Reference Books	1. Mathur, M., and Sharma, R.P., " Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1991. 2. Cornelisse, J.W., " Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1912. 3. Parket, E.R., " Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1912.
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Composite Material **Course Code: 17YASE02**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	1	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite	1. Mechanics of Solids 2. Aerospace Structure 3. Engineering Mathematics

Course Objectives	
1	Know the types of composites.
2	Understand the need for stress strain relation.
3	Understand the fabrication methods.
4	Understand the laminated plate.
5	Study and understand the different methods & analysis of composite materials.

Course Content		
Unit No.	**Content**	**Hours**
1	**STRESS STRAIN RELATION** Introduction- Advantages and application of composite materials, reinforcements and matrices - Generalised Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials.	**10**
2	**METHODS OF ANALYSIS** Micro mechanics - Mechanics of materials approach, elasticity approach to determine material properties - Macro Mechanics - Stress-strain relations with respect to natural axis, arbitrary axis - Determination of material properties. Experimental characterization of lamina.	**15**
3	**LAMINATED PLATES** Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.	**10**

4	**SANDWICH CONSTRUCTIONS** Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.	**10**
5	**FABRICATION PROCESS** Various Open and closed mould processes. Manufacture of fibers - Types of resins and properties and applications - Netting analysis	**05**
	Total	**50**

Beyond the Syllabus
1. 2.

Course Outcome	
Students should able to	
CO1	Analysis of composite structures
CO2	Do microscopic and macroscopic analysis
CO3	Analyze sandwich and laminated plates
CO4	Understand fabrication techniques
CO5	Construct and analysis different composite technique

Recommended Resources	
Text Books	1. Calcote, L R. "The Analysis of laminated Composite Structures", Von - Noastrand Reinhold Company, New York 1991. 2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1915
Reference Books	1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995. 2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1919.
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Unmanned Aerial Vehicle **Course Code: 17YASE03**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	10	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.Basic electronics and avionics

Course Objectives	
1	To introduce the concept of UAV and its applications.
2	Explain the various aspects of UAV.
3	Understand modelling and control of helicopter models.
4	Explain the concept of UAV design, modelling and control.
5	Understand application based deployment of UAV systems.

Course Content		
Unit No.	**Content**	**Hours**
1	**INTRODUCTION TO UAS** History of unmanned aerial vehicles- types- Introduction to Unmanned aircraft systems-Unmanned aerial vehicles –Micro aerial vehicles definitions, history, classification- applications-recent research and development in civil and defence applications – autonomous vehicles -future research in autonomous vehicles – design standards and regulatory aspects introduction to design and selection of systems	**10**
2	**ASPECTS OF UAS SYSTEMS** Involvement of different aspects in the development of UAV-aerodynamic configurations -Aspects of airframe design- Stealth design, payload types, communication, navigations & guidance systems, control & stability, launch, recovery and support systems, reliability design	**10**
3	**MODELING AND CONTROL HELICOPTER MODEL** Modelling and control of small and miniature unmanned helicopters –single rotor helicopter design – coaxial rotor helicopter design - autonomous control of a mini quad rotor vehicle using LQG controllers – linearization	**10**

	and identification of helicopter model.	
4	**UAV DESIGN MODELING & CONTROL** Development of autonomous quad tilt wing – advanced flight control systems for rotorcraft UAV and MAV – mathematical modelling and nonlinear control of VTOL aerial vehicles	**10**
5	**DEPLOYMENT OF UAS/UAV SYSTEMS** Only application point of view of various UAS roles played in civil, defense applications -vision based navigation company trails- certification of UAS/UAV/MAV systems	**10**
	Total	**50**

Beyond the Syllabus
1. 2.

Course Outcome	
Students should able to	
CO1	Elucidate the various aspects related to UAV's.
CO2	Explain the modelling and control parameters associated with helicopter models.
CO3	Outline the modelling and design aspects related to UAV's.
CO4	Describe the deployment of UAV systems in various functional areas.

Recommended Resources
Text Books
Reference Books
E-Resources

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Operation Research **Course Code: 17YASE04**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	10	20	10	10	50	100	50	100
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.

Course Objectives	
1	Students will calculate optimal solution variants of assignment problem.
2	Students will apply sequencing and replacement procedures
3	Students will apply the game theory
4	Students will learn the applications of finite and infinite population
5	Students will learn different type of simulation models

Course Content		
Unit No.	**Content**	**Hours**
1	**Allocation:** Linear Programming Problem Formulation – Graphical solution Simple method – Artificial variables techniques: Two–phase method, Big-M method.	**08**
2	**Transportation Problem** – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. **Assignment problem** – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.	**10**
3	**Sequencing** – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines **Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.	**10**

4	**Theory of Games:** Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method. **Inventory:** Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks – Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.	**10**
5	**Waiting Lines:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population. Dynamic Programming: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem. **Simulation:** Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages- applications of simulation to queuing and inventory.	**12**
	Total	**50**

Beyond the Syllabus
1.
2.

Course Outcome	
Students should able to	
CO1	Summerize the importance of operational research
CO2	Estimate transportation and assignment problem
CO3	Calculate replacement of items that deteriorate with time
CO4	Distinguish different aspects of game theory and inventory control
CO5	Categorise different types of simulation models

Recommended Resources	
Text Books	
Reference Books	1. Operations Research /J.K.Sharma 4e. /MacMilan 2.Introduction to O.R/Hillier & Libermann/TMH 3.Introduction to O.R /Taha/PHI 4.Operations Research/ NVS Raju/ SMS Education/3rd Revised Edition 5. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education. 6.Operations Research / Wagner/ PHI Publications.

	7.Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Automatic Control System **Course Code: 17YASA07**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
0	0	0	0	0	0	0	0	0	0	0	0
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.

Course Objectives	
1	At the conclusion of this course, the students will be able to: Describe the transfer functions for automatic control systems; open-loop and closed-loop systems.
2	Describe the various time domain and frequency domain tools for analysis and design of linear control systems.
3	Describe the methods to analyze the stability of systems from transfer function forms.
4	Describe the methods to analyze the stability of systems from transfer function forms.
5	Describe the methods to analyze the sampled-data control systems

Course Content		
Unit No.	**Content**	**Hours**
1	INTRODUCTION TO AUTOMATIC CONTROL SYSTEMS:- Historical review, Examples of control systems: simple pneumatic, hydraulic and thermal systems, series and parallel systems, analogies, mechanical and electrical components.	**10**
2	OPEN AND CLOSED LOOP SYSTEMS : Closed loop control versus open loop control, Feedback control systems, Block diagram representation of control systems, reduction of block diagrams, Output to input ratios.	**10**
3	TRANSIENT AND STEADY-STATE RESPONSE ANALYSIS : Laplace transformation, Response of systems to different inputs viz. Step, impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.	**10**

4	STABILITY ANALYSIS : Stability definitions, characteristic equation, location of roots in the s-plane for stability, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, concept and construction, frequency response.	**10**
5	SAMPLED DATA CONTROL SYSTEMS :- Sampled data control systems - functional elements-sampling process – z transforms- properties - inverse z-transforms- response between samples modified z-transforms - ZOH and First order Hold process- mapping between s and z planes - pulse transfer functions - step response – stability analysis Jury's stability test.	**10**
	Total	**50**

Beyond the Syllabus
1.
2.

Course Outcome
Students should able to
CO1
CO2
CO3
CO4
CO5

Recommended Resources	
Text Books	1. Katsuhiko Ogata., "Modern Control Engineering", 4th edition, Prentice Hall of India Private Ltd, NewDelhi, 2004. 2. Nagrath, I J and Gopal, .M., "Control Systems Engineering", 4th edition, New Age International Pvt. Ltd., New Delhi, 2006.
Reference Books	1. Benjamin, C Kuo., "Automatic Control System", 7th edition, Prentice Hall of India Private Ltd, New Delhi, 1993. 2. Richard, C. Dorf and Robert H. Bishop., "Modern Control System Engineering", Addison Wesley, 1999.
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Introduction to NDT **Course Code: 17YASA08**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
0	0	0	0	0	0	0	0	0	0	0	0
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.

Course Objectives	
1	Study the basics of NDT, its history and applications.
2	Study the process of various visual testing techniques used in NDT.
3	Study the process of radiographic testing and its applications.
4	Study the process of ultrasonic testing and its applications.
5	Study the other methods used in NDT technique.

Course Content		
Unit No.	**Content**	**Hours**
1	Introduction to NDT, concern in NDT, History, NDT vs. Destructive, Conditions for NDT, Personal Considerations, Certification, Primary production of metal, castings, cracks, welding discontinuities, corrosion induced discontinuities, fatigue cracking, creep, brittle fracture, geometric discontinues.	**10**
2	History and Development, Theory and Principles, Equipment and Accessories, Applications and Techniques, Evaluation of Test Results, Advantages and Limitations, Penetrate Testing- Introduction, History and Development, Theory and Principles, Penetrate Equipment and Materials, Penetrant Procedures, Techniques and Variables, Evaluation and Disposition, Penetrate Testing Applications, Quality Control Considerations, Advantages and Limitations, Glossary of Penetrate Testing Terms, Magnetic Particle Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Evaluation of Test Results and Reporting, Applications, Advantages and Limitations.	**10**

3	History and Development, Theory and Principles, Radiographic Equipment and Accessories, Variables, Techniques and Procedures, Radiographic Evaluation, Applications, Advantages and Limitations of Radiography, Compendium of Radiographs	**10**
4	History, Theory and Principles, Equipment for Ultrasonic Applications, Techniques, Variables, Evaluation of Test Results, Applications, Advantages and Limitations, Eddy Current Testing- History and Development, Theory and Principles, Alternating Current Principles, Eddy Currents, Test Equipment, Eddy Current Applications and Signal Display, Advantages and Limitations, Other Electromagnetic Test Techniques	**10**
5	Thermal Infrared Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Data Storage, Applications, Advantages and Limitations, Acoustic Emission Testing - History and Development, Principles of Acoustic Emission Testing, Advantages and Limitations of Acoustic Emission Testing.	**10**
	Total	**50**

Beyond the Syllabus
1. 2.

Course Outcome	
Students should able to	
CO1	Understand the background of NDT and its applications.
CO2	Understand the different methods of visual testing and their advantages.
CO3	Understand the technique of radiographic testing and its equipments.
CO4	Understand the technique of ultrasonic testing and its equipments
CO5	Understand other different method used in NDT.

Recommended Resources	
Text Books	P. E. Mix, "Introduction to non-destructive testing", Wiley Interscience,, John Wiley & Sons, Inc, Publ., 2005
Reference Books	C. Hellier, "Handbook of Nondestructive Evaluation", McGraw-Hill, 1994.
E-Resources	

SANDIP UNIVERSITY

School of Engineering and Technology

Aerospace Engineering

Year: TE B.Tech **Semester: VII**

Course : Combustion Engineering **Course Code: 17YASA09**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
0	0	0	0	0	0	0	0	0	0	0	0
Max. Time, End Semester Exam (Theory) - NA									End Semester Exam (Lab) - 3Hrs.		

Prerequisite 1.

Course Objectives	
1	Concepts in combustion
2	To make combustion calculations
3	To know supersonic combustion
4	To understand the Combustion in rockets
5	To learn the Supersonic combustion

Course Content		
Unit No.	**Content**	**Hours**
1	FUNDAMENTAL CONCEPTS IN COMBUSTION : Thermo - chemical equations - Heat of reaction first order, second order and third order reactions — premixed flames - Diffusion flames	**10**
2	CHEMICAL KINETICS AND FLAMES : Measurement of burning velocity - Various methods - Effect of various parameters on burning velocity - Flame stability - Detonation - Deflagration Rankine – Hugoniot curve - Radiation by flames.	**10**
3	-COMBUSTION IN GAS TURBINE ENGINES : Combustion in gas turbine combustion chambers - Re-circulation – Combustion efficiency - Factors affecting combustion efficiency - Fuels used for gas turbine combustion chambers - Combustion stability - Flame holder types – Numerical problems.	**10**
4	COMBUSTION IN ROCKETS : Solid propellant combustion - Double base and composite propellant combustion - Various combustion models - Combustion in liquid rocket engines - Single fuel droplet combustion model - Combustion in hybrid rockets.	**10**

5	SUPERSONIC COMBUSTION : Introduction - Supersonic combustion controlled by mixing, diffusion and heat convection - Analysis of reaction and mixing processes - Supersonic burning with detonation shocks.	**10**
	Total	**50**

Beyond the Syllabus
1.
2.

Course Outcome
Students should able to
CO1
CO2
CO3
CO4
CO5

Recommended Resources	
Text Books	1. Sharma, S.P., and Chandra Mohan, "Fuels and Combustion", Tata McGraw Hill Publishing Co., Ltd., New Delhi 1987. 2. Loh, W.H.T., Jet Rocket, "Nuclear, Ion and Electric Propulsion Theory and Design", Springer Verlag, New York 1982.
Reference Books	1. Beer, J.M. and Chigier, N.A., Combustion Aerodynamics, Applied Science Publishers Ltd., London, 1981. 2. Chowdhury, R., Applied Engineering Thermodynamics, Khanna Publishers, New Delhi, 1986. 3. Sutton, G.P., and Biblarz, 0., Rocket Propulsion Elements, 7th Edition John Wiley and Sons, Inc., New York, 2001. 4. Mathur, M., and Sharma, R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers,New Delhi, 1988. 5. Turns, S.R., An Introduction to Combustion Concepts and Applications, 2nd Edition. McGraw Hill International Editions, New Delhi, 2000.
E-Resources	