MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Sponsored by CMR Educational Society

(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2008 Certified)

Maisammaguda, Dhulapally (Post Via Hakimpet), Secunderabad – 500100, Telangana State, India.

Contact Number: 040-23792146/64634237, E-Mail ID: mrcet2004@gmail.com,website:www.mrcet.ac.in

MASTER OF TECHNOLOGY
AEROSPACE ENGINEERING

DEPARTMENT OF
AERONAUTICAL ENGINEERING

ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABUS

(Batches admitted from the academic year 2017 - 2019)

Note: The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

"Autonomous Institution /College" means an institution/college designated as autonomous institute / college by University Grants Commission (UGC), as per the UGC Autonomous College Statutes.

- "Academic Autonomy" means freedom to a College in all aspects of conducting its academic programs, granted by the University for promoting excellence.
- "Commission" means University Grants Commission.
- "AICTE" means All India Council for Technical Education.
- "University" the Jawaharlal Nehru Technological University, Hyderabad.
- "College" means Malla Reddy College of Engineering & Technology, Secunderabad unless indicated otherwise by the context.
- "Program" means:

  Master of Technology (M.Tech) degree program
  PG Degree Program: M.Tech

- "Branch" means specialization in a program like M.Tech degree program in Aeronautical Engineering, M.Tech degree program in Computer Science and Engineering etc.
- "Course" or "Subject" means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester.
- T–Tutorial, P–Practical, D–Drawing, L-Theory, C-Credits

FOREWORD

The autonomy is conferred on Malla Reddy College of Engineering & Technology (MRCET) by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

Malla Reddy College of Engineering & Technology (MRCET) is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, and also improving upon the values and beliefs for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several experts drawn from academics, industry and research, in accordance with the vision and mission of the college which reflects the mindset of the institution in order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and brighter prospects of engineering graduates.

"A thought beyond the horizons of success committed for educational excellence"

PRINCIPAL

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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VISION

- To establish a pedestal for the integral innovation, team spirit, originality and competence in the students, expose them to face the global challenges and become technology leaders of Indian vision of modern society.

MISSION

- To become a model institution in the fields of Engineering, Technology and Management.
- To impart holistic education to the students to render them as industry ready engineers.
- To ensure synchronization of MRCET ideologies with challenging demands of International Pioneering Organizations.

QUALITY POLICY

- To implement best practices in Teaching and Learning process for both UG and PG courses meticulously.
- To provide state of art infrastructure and expertise to impart the quality education.
- To groom the students to become intellectually creative and professionally competitive.
- To channelize the activities and tune them in heights of commitment and sincerity, the requisites to claim the never ending ladder of SUCCESS year after year.

For more information: www.mrcet.ac.in

DEPARTMENT OF AERONAUTICAL ENGINEERING

M.TECH – AEROSPACE ENGINEERING

COURSE STRUCTURE & SYLLABUS

I Year I Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D7601	Aerodynamics of Flight Vehicles	4	-	3	30	70
2	R17D7602	Engineering Analysis of Flight Vehicles	4	-	3	30	70
3	R17D7603	Rocket and Missile Technology	4	-	3	30	70
4	R17D7604 R17D7605 R17D7606	Elective-1 1) Fundamentals of Aerospace Engineering * 2) Air-breathing Propulsion And Design 3)Flight Vehicle Structures	4	-	3	30	70
5	R17D7607 R17D7608 R17D7609	Elective-2 1)Modeling and Simulation of Fluid Flows 2)Computational Structural Analysis 3)Integrated Aircraft systems	4	-	3	30	70
6	R17DEC51 R17DCS51 R17DME51 R17DAE51	Open Elective-I 1)Embedded Systems Programming 2)Scripting Languages 3)Non Conventional Energy sources 4)Mathematical Modeling Techniques	4	-	3	30	70
7	R17D7681	Digital Simulation Lab-I	-	3	2	30	70
8	R17D7682	Technical Seminar - I	-	-	2	50	
Total			24	3	22	260	490

NOTE: *Fundamentals of Aerospace Engineering

(Required to be taken by all students other than B.Tech Aeronautical/ Aerospace Engineering degree holders)

I Year II Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D7610	Aircraft Control and Simulation	4	-	3	30	70
2	R17D7611	Aerospace Sensors and Measurement Systems	4	-	3	30	70
3	R17D7612	Computational Approaches to Aerospace Vehicle Design	4	-	3	30	70
4	 R17D7613 R17D7614 R17D7615	Elective-III 1)Aero-thermodynamics of Hypersonic Flight 2) Advanced Topics in Air Traffic Management Systems 3)Spacecraft Dynamics and Control	4	-	3	30	70
5	 R17D7616 R17D7617 R17D7618	Elective-IV 1) Communication Navigation and Surveillance Systems 2)Space Transportation Systems 3)Dynamics and Control of Structures	4	-	3	30	70
6	 R17DCS53 R17DME52 R17DEC52 R17DCS52	Open Elective- II 1) Research Methodology 2) Industrial Management 3)Internet of Things 4) Information Security	4	-	3	30	70
7	R17D7683	Digital Simulation Lab-II	-	3	2	30	70
8	R17D7684	Technical Seminar-II	-	-	2	50	
Total			24	3	22	260	490
Total			-	-	22	-	-

M.TECH - III -Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D7685	Technical Seminar-III	-	-	2	50	-
2	R17D7691	Project Review-I	-	-	10	100	-
3	R17D7692	Project Review-II			10	100	
Total			-	-	22	-	-

M. Tech –IV- Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D7686	Technical Seminar-IV	-	-	2	50	-
2	R17D7693	Project Review-III	-	-	10	100	-
3	R17D7694	Project Viva -voce			10		100
Total			-	-	22	-	-

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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L	T/P/D	C
4	-	3

(R17D7601) AERODYNAMICS OF FLIGHT VEHICLES

UNIT-I: REVISION OF BASICS LEARNT AT UNDER GRADUATE LEVEL IN BRIEF

AERODYNAMIC CHARACTERISTICS OF AIRFOILS: Vortex sheet, Vortex sheet in thin-airfoil theory, Planar wing, Properties of symmetrical airfoil, Properties of cambered airfoil, Flapped airfoil, Numerical Solution of thin airfoil problem, Airfoil of arbitrary thickness and camber

UNIT II: THE FINITE WING

Flow fields around finite wings, Downwash and induced drag, Fundamental equations of finite-wing theory, Elliptical lift distribution, Arbitrary circulation distribution, Twisted wing: Basic and Additional lift, Approximate calculation of additional lift, Winglets, Stability and trim of wings, Higher approximations, The complete airplane, Interference effects,

AIRFOILS IN COMPRESSIBLE FLOWS

Boundary conditions, subsonic airfoils Prandtl-Glauert transformation, Critical Mach number, Drag divergence Mach number, Airfoils in transonic flow, Airfoils in supersonic flow

UNIT-III: **WINGS AND WING-BODY COMBINATIONS IN COMPRESSIBLE FLOW**

Wings and bodies in compressible flows: Prandtl-Glauert-Goethert transformation, Influence of sweepback, Design rules for wing-fuselage combinations

LAMINAR BOUNDARY LAYER IN COMPRESSIBLE FLOW

Conservation of energy in the boundary layer, Rotation and entropy gradient in the boundary layer, Similarity considerations for compressible boundary layers, Solution of energy equation for Prandtl number unity, Temperature recovery factor, Heat transfer versus skin friction, Velocity and temperature profiles and skin friction, Effects of pressure gradient

UNIT-IV: **FLOW INSTABILITIES AND TRANSITION FROM LAMINAR TO TURBULENT FLOW**

Gross effects, Reynolds experiment, Tollmien-Schlichting instability and transition, Natural laminar flow and laminar flow control, Stability of vortex sheets, Transition phenomenon, Methods for experimentally detecting transition, Flow around spheres and circular cylinders

TURBULENT FLOWS

Description of turbulent field, Statistical properties, Conservation equations, Laminar sub-layer, Fully developed flows in tubes and channels, Constant-pressure turbulent boundary layer, Turbulent drag reduction, Effects of pressure gradient, Stratford criterion for turbulent separation, Effects of compressibility on skin friction, Reynolds analogy: Heat transfer and temperature recovery factor, Free turbulent shear flows

AIRFOIL DESIGN, MULTIPLE SURFACES, VORTEX LIFT, SECONDARY FLOWS, VISCOUS EFFECTS

Airfoil design for high C_{lmax}, multiple lifting surfaces, Circulation control, Stream wise vorticity, Secondary flows, Vortex lift strakes, Flow about three-dimensional bodies, unsteady lift

UNIT-V: UNSTEADY AERODYNAMICS

Unsteady lifting force coefficient, Unsteady aerodynamics of slender wings, Compressible Unsteady aerodynamics, Equations of motion, Boundary condition, Moving coordinate system, Navier Stoke equations, Aerodynamic forces and moments, Turbulence modelling, Numerical Problems

INCOMPRESSIBLE FLOW OVER AN AIRFOIL

Steady flow, Unsteady flow, Simple Harmonic Motion, Lowey's problem: returning Wake problem, Arbitrary motion and Wagner Function, Gust problem and Kussner function. Numerical Problems

INCOMPRESSIBLE FLOW OVER WINGS

Steady flow: Lifting line theory (results), Weissinger's L – method, Low aspect ratio wings, unsteady flow: Reissner's Approach, Numerical solutions, Numerical Problems

TEXT BOOKS

1. *Foundations of Aerodynamics*: Bases of Aerodynamic Design, Arnold M. Kuethe and Chuen- Yen Chow, John Wiley & Sons, Inc., Fifth Edition, 1997, ISBN: 978-0-471-12919-6

1. *Fundamentals of Modern Unsteady Aerodynamics*, Gulcat, Ulgen, Springer, Publications, ISBN 978-3-642-14761-6

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L	T/P/D	C
4	-	3

(R17D7602) ENGINEERING ANALYSIS OF FLIGHT VEHICLES

UNIT-I: **THE MORPHOLOGY OF FLIGHT VEHICLES**
Introduction, Key factors affecting vehicles configuration, some representative flight vehicles.

UNIT-II: **EQUATIONS OF MOTION FOR RIGID FLIGHT VEHICLES**
Definitions, Vector and Scalar realizations of Newton's second law, The tensor of inertia, Choice of vehicle axes, Principal axes, Stability axes, Aerodynamic axes, Orientation of the vehicle relative to the ground; flight path determination, Gravitational terms in the equations of motion, The state vector, Equations of motion; Aerodynamic Approximations; stability derivatives; Estimation of stability derivatives: Longitudinal.

INTRODUCTION TO VEHICLE AERODYNAMICS
Aerodynamics contributions to X, Y and M, dimensionless coefficients defined, equations of perturbed longitudinal motion.

UNIT-III: **AIRCRAFT DYNAMICS**
Equations of Motion of Aircraft including forces and moments of control surfaces, Dynamics of control surfaces

STATIC STABILITY, TRIM STATIC PERFORMANCE AND RELATED SUBJECTS
Impact of stability requirements on design and longitudinal control, Static performance

UNIT-IV: **DYNAMIC PERFORMANCE OF SPACECRAFT WITH RESPECT TO NON-ROTATING PLANETS**
Introduction, Numerical integration of ordinary differential equations, Simplified treatment of boost from a non-rotating planet, An elementary look at staging, Equations of boost from a rotating planet.

UNIT-V: **DYNAMIC PERFORMANCE OF SPACECRAFT**
Equations of Motion of Launch Vehicles with respect to a rotating planet, Motion of Spacecraft with respect to a rotating planet.

DYNAMIC PERFORMANCE-ATMOSPHERIC ENTRY
Equation of motion, Approximate analysis of gliding entry into a planetary atmosphere.

TEXT BOOK

1. *Engineering Analysis of Flight Vehicles*, Holt Ashley, Dover Publications, 1992

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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L	T/P/D	C
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(R17D7603) ROCKET AND MISSILE TECHNOLOGY

UNIT-I: INTRODUCTION

Rockets and military missiles – function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements Performance measures, design, construction ,operation-similarities and differences .Some famous space launch vehicles and strategic missiles.

UNIT-II: SOLID AND LIQIUD PROPULSION SYSTEMS

Solid propellant rocket motors, principal features .applications, solid propellants, types, composition, properties, performance. Propellantgrain, desirableproperties, grainconfiguration, preparation. loading. structural design of grain .Combustion instabilities. Liners, insulators and inhibitors-function, requirements, materials. Rocket motor casing –materials. Nozzles –types, design- construction, thermal protection. Igniters, types, construction. Description of modern solid boosters I) Space Shuttle SRB II) the Arienne SRB

Liquid propellants –types, composition, properties. Performance .Propellant tanks, feed systems – pressurisation, turbo-pumps-valves and feed lines, injectors, starting and ignition .Engine cooling support structure. Control of engine starting and thrust build up. System calibration, integration and optimization –safety and environmental concerns combustion instabilities. Description of the space shuttle main engine .Propellant slosh, propellant hammer, geysering effect in cryogenic rocket engines. Tsiolskovsky's rocket equation in the absence of gravity, vertical motion in the earth's gravitational field , inclined motion , flight path at constant pitch angle , motion in the atmosphere , the gravity turn-the culmination altitude, Multi staging. Earth launch trajectories –vertical segment , the gravity turn ,constant pitch trajectory , orbital injection. Actual launch vehicle trajectories –types. Examples, the Mu-3-S-II. Ariane, Pegasus launchers, Reusable launch vehicles – future launchers –launch assist technologies

UNIT-III: AERODYNAMICS OF ROCKETS AND MISSILES AND ATTITUDE CONTROL

Classification of missiles, Airframe components of rockets and missiles. Forces acting on a missile while passing through atmosphere, method of describing aerodynamic forces and moments .lateral aerodynamic moment ,lateral damping moment , longitudinal moment of a rocket, lift and drag forces, drag estimation ,body up wash and down wash in missiles. Rocket dispersion. re-entry body design considerations Rocket thrust vector control – methods of thrust vector control for solid and liquid propulsion systems, thrust magnitude control .thrust termination; stage separation dynamics , separation techniques

UNIT-IV: MATERIALS AND ROCKET TESTING

Criteria for selection of materials for rockets and missiles- requirements for choice of materials for propellant tanks, liners, insulators, inhibitors, at cryogenic temperatures, requirements of materials at extremely high temperatures, requirements of materials for thermal protection and for pressure vessels.Ground testing and flight testing-types of tests, test facilities and safeguards monitoring and control of toxic materials, instrumentation and data management. Ground testing, flight testing, trajectory monitoring, post accident procedures. Description of a typical space launch vehicle launches procedure.

UNIT-V: ALTERNATIVE PROPULSION SYSTEMS AND FLIGHT VEHICLES

Hybrid propulsion system .Ramjet propulsion and its performance and limitations, the scramjet engine – construction , flow process , drag components , fuel injection systems , applications , components performance analysis –Hypersonic transport vehicles, missions , trajectories, sounding rockets , cruise missiles , unmanned Aerial Vehicles and drones , Micro Aerial Vehicles – applications of these vehicles

TEXT BOOKS

1. Sutton, GP. and Biblarz, ., *Rocket Propulsion Elements*,7th edition, Wiley-Interscience, 2000.
2. Cornelisse, J.W., Schoyer H.F.R. and Wakker. K.F.,*Rocket propulsion and space flight dynamics* ,pitman 1979
3. Turner ,M.J.L., *Rocket and Spacecraft Propulsion* ,springer ,2001
4. Hill ,PG. and Peterson ,CR, *Mechanics and Thermodynamics of propulsion* , 2nd edition , Addison Wesley ,1992

REFERNCE BOOKS

1. Anderson JD., *Introduction to flight* 5th edition ,Tata McGraw Hill ISBN: 0-07-006082-4
2. *James all the world flight vehicles* Jones aviation publications London

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L	T/P/D	C
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(R17D7604) FUNDAMENTALS OF AEROSPACE ENGINEERING* (ELECTIVE-I)

UNIT-I: **INTRODUCTION TO AEROSPACE ENGINEERING**
Brief history of Aeronautics, Anatomy of the Airplane, Anatomy of a Space Vehicle, The Nature of Aerodynamic forces and dimensional analysis; Theory and experiment: wind tunnels, Atmosphere: Properties of U.S. standard atmosphere, Definitions of altitude,

UNIT-II: **INCOMPRESSIBLE ONE DIMENSIONAL FLOWS AND COMPRESSIBLE FLUIDS**
Continuity equation, Bernoulli's equation, Application of Bernoulli's equation: Airspeed indicators and wind tunnels, One-dimensional compressible flow concepts, Speed of sound, Compressible flow equations in a variable-area stream tube, Application to airspeed measurement, Applications to channels and wind tunnels

TWO-DIMENSIONAL FLOW AND FINITE WING: Limitations of one-dimensional flow equations, Theory of lift: circulation, Airfoil pressure distribution, Helmholtz vortex theorems, Simulating the wing with a vortex line, Downwash, Elliptic lift distribution, Lift and drag: momentum and energy, Slope of finite wing lift curve, Verification of Prandtl wing theory, Additional effects of wing vortices, Search for reduced induced drag

UNIT-III: **EFFECTS OF VISCOSITY, TOTAL DRAG**
Boundary layer, Boundary layer on bluff bodies, Creation of circulation, Laminar and turbulent boundary layers: skin friction, Nature of Reynolds number, Effect of turbulent boundary layer on separation; Parasite drag, Drag due to lift, Importance of aspect ratio; Prediction of drag divergence Mach number, Sweptback wings, Total drag, Supersonic flow: shock waves and Mach waves, Supersonic wing lift and drag, Area rule, Supersonic aircraft,

AIRFOILS, WINGS AND HIGHLIFT SYSTEMS: Early airfoil development, Modern airfoils, Supersonic airfoils, Airfoil pitching moments, Effects of sweepback on lift, airfoil characteristics, Airfoil selection and wing design; Airfoil maximum lift coefficient, Leading and trailing edge devices, Effect of sweepback, Deep stall, Effect of Reynolds number, Propulsive lift

UNIT-IV: **AERODYNAMIC PERFORMANCE, STABILITY AND CONTROL**
Level flight performance, Climb performance, Range, Endurance, Energy-state approach to airplane performance, Takeoff performance, landing performance; Static longitudinal stability, Dynamic longitudinal stability, Dynamic lateral stability, Control and Maneuverability: turning performance, Control systems, Active controls

UNIT-V: **AEROSPACE PROPULSION AND AIRCRAFT STRUCTURES**
Aerospace Propulsion: Piston engines, Gas turbines, Speed limitations of gas turbines: ramjets, Propellers, Overall propulsion efficiency, Rocket engines, Rocket motor performance, Propulsion-airframe integration; Aircraft structures: Importance of structural weight and integrity, Development of aircraft structures, Importance of fatigue, Materials, Loads, Weight estimation

ROCKET TRAJECTORIES, ORBITS AND REENTRY
Rocket trajectories, Multistage rockets, Escape velocity, Circular orbital or satellite velocity, Elliptical

orbits, Orbital maneuvers.

TEXT BOOK

1. *Fundamentals of Flight*, Richard S. Shevell, Pearson Education Publication, ISBN 81-297-0514-1, 1989

REFERENCE BOOK

2. *Introduction to Flight*, John D. Anderson, Jr., Tata McGraw-Hill Publishing Company, Fifth Edition, Fifth Edition, 2007, ISBN 13: 978-0-07-066082-3

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(R17D7605) AIR-BREATHING PROPULSION AND DESIGN (ELECTIVE-I)

UNIT-I: **FUNDAMENTALS OF JET PROPULSION**
Aircraft Propulsion, Thermodynamic relations and cycles involved, Classification of Air breathing Engines, Ideal and Real Cycle Analysis - Turbojet and Turbofan, Effects of Altitude, Mach number, Aircraft Performance and Engine Performance analysis, Aircraft Engine Design, Methods employed for Thrust Augmentation and Jet Engine Noise suppression.

UNIT-II: **INLETS AND NOZZLES**
Types of Inlets, Combined Area Changes and Friction, Supersonic Inlet Design Considerations, Engine Starting, Effect of Additive Drag, Types of nozzles, Performance Map, Non-ideal equations for Various Nozzles, Effects of Pressure Ratios on Engine Performance, Performance Maps, Methods and advantages in reversing the Thrust, Types of Thrust Vectoring.

COMBUSTION CHAMBER
Classification of combustion chamber, Process of Combustion, factors affecting combustion, Chemical Kinetics, Properties of various fuels used in aviation, Flame Stabilization, Ignition and Engine Starting, Adiabatic Flame Temperature, Pressure Losses, Design and Optimization, Performance Maps.

UNIT-III: COMPRESSORS AND TURBINES
Classification of Compressors, Euler’s Turbo-Machinery Equations, components of axial flow compressor, stage, Velocity Triangles, Single-Stage Energy Analysis, Variable Stators, Radial Equilibrium and Streamline Analysis Method; Centrifugal Compressors- Geometry, Velocity triangles, Impeller Design, Performance Maps;
Axial Flow Turbines- Geometry, Single-Stage Energy analysis, Velocity Triangles, Performance Maps, Thermal Limits of Blades and Vanes, Numerical problems and Performance Analysis.

RAMJETS
Working principle of Ramjet engine, Combustors for liquid fuel ramjet engines, Combustion Instability and its Suppression, Solid fuel Ramjet Engines, Test bed of Ramjet engine, Advancements in ramjets-Ram-rockets- Performance analysis, Ducted and Shrouded types, Air-augmented rockets, Integrated ramjet-rocket systems, Nozzle-less solid propellant rockets and Integrated Ramjet-rocket boosters, Dump combustors. Problems related to combustion, CFD techniques and guide lines required in designing and development of combustor employed in ramjets.

UNIT-IV: **HYPERSONIC AIR-BREATHING PROPULSION**
Hypersonic Air-breathing Propulsion, SCRAM jet engines-Methods of Analysis, Hypersonic Intakes, Supersonic Combustors, Engine Cooling and Materials Problem, CFD Applications, Liquid Air-cycle Engines, Space Plane Applications, Experimental and Testing Facilities, The Shock tube and shock Tunnel, Hypersonic wind tunnel.

UNIT-V: **DESIGN OF GAS TURBINE ENGINE**
Aircraft Mission Analysis, Engine Selection- Performance and Parametric Analysis, Sizing the Engine, Major Considerations in Engine Component Design - Rotating Turbo-machinery, Combustion Systems,

Inlets and Exhaust Nozzles

SYSTEM MATCHING AND ANALYSIS

Matching of Gas Turbine Components, Cycle Analysis of one and two spool engines, Gas Generator, Component Modeling, Solution of Matching Problem, Dynamic or Transient behavior, Matching of Engine and Aircraft, Use of Matching and Cycle analysis in Second stage design

TEXT BOOKS

1. *Gas Turbine theory*, Cohen H., Rogers G.F.C, Saravanamutto H., Longman Publication, 4th Edition, 2003
2. *Elements of Propulsion*: Gas turbines and Rockets, Jack D. Mattingly, AIAA Education series, 2nd Edition, 2006
3. *Aircraft Engine Design*, Jack D. Mattingly, AIAA Education Series, 2nd Edition, 2008.
4. *Hypersonic Air breathing Propulsion*, William H. Heiser, David T. Pratt, AIAA Education Series, 1st Edition, 1994

REFERENCE BOOK

1. *Gas Tables*, Third edition E. Radha Krishnan, University press.
2. *Fundamentals of Jet Propulsion with applications*, Ronald D. Flack, Cambridge University Press, 1st Edition, 2005.

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L	T/P/D	C
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(R17D7606) FLIGHT VEHICLE STRUCTURES
(ELECTIVE-I)

UNIT-I: AIRCRAFT STRUCTURAL MATERIALS

Aluminium Alloys, Steel, Titanium, plastic, glass, composite materials, properties of materials, Testing of Engineering Materials : Tensile test, Compression test, Bending Stress, Shear Test, Hardness Test, Impact Test, Stress- Strain Curve. Strain Hardening, Creep Relaxation

STRUCTURAL COMPONENTS AND LOADS OF AIRCRAFT

Loads on Structural components, Function of structural components, Fabrication of structural components, Connections; Airworthiness: Factors of Safety- flight envelope, Load factor determination, Airframe loads: Aircraft inertia loads, Symmetric maneuver loads, Normal accelerations associated with various types of maneuvers, Gust loads

UNIT-II: **SHEAR FLOW AND SHEAR CENTER IN OPEN AND CLOSED THIN WALL SECTIONS**

Open Sections: Shear center and elastic axis, Concept of shear flow, Beams with one axis of symmetry; Closed Sections: Bradt-Batho formula, Single and multi-cell closed box structures, Semi monocoque and mono cocque structures, Shear flow in single and multi cell mono cocque and semi mono cocque box beams subject to torsion

UNIT-III: **THIN PLATE THEORY**

Bending of thin plates: Pure bending of thin plates, Plates subjected to bending and twisting, Plates subject to distributed transverse load, Combined bending and in-plane loading of a thin rectangular plate, Bending of thin plates having a small initial curvature, Energy method for bending of thin plates

UNIT-IV: **BENDING, SHEAR AND TORSION OF THIN-WALLED BEAMS-I**

Bending and Open Thin-Walled Beams: Symmetrical bending, Unsymmetrical bending, Deflections due to bending, Calculation of section properties, Applicability of bending theory, Temperature effects

STRESS ANALYSIS OF AIRCRAFT COMPONENTS

Wing spars, Fuselages, Wings, Fuselage frames and wing ribs, laminated composite structures

UNIT-V: **SMART MATERIALS AND ADAPTIVE STRUCTURES**

Smart Materials Technologies and Control Applications: Control requirements, Smart Materials-Piezoelectric elements, Electrostrictive elements, Magentostrictive transducers, Electrorheological fluids, Shape memory alloys, Fiber optic sensors, Applications of smart materials, Adaptive Structures: Adaptive aerospace structures-Structural Health Monitoring (SHM), Shape control and active flow, Damping of vibration and noise, Smart skins, Systems

TEXT BOOK

1. *Aircraft Structures for Engineering Students*, Fourth Edition, T. H. G. Megson, Butterworth-Heinemann, Elsevier Ltd, 2007

REFERENCE BOOKS

1. *Mechanics of Aircraft Structures*, Second Edition, C. T. Sun**,** John Wiley & Sons, 2006
2. *Theory and Analysis of Flight Structures***,** Robert M. Rivello, McGraw-Hill, 1969
3. *Airplane Structural Analysis and Design*, Earnest E. Sechler, Lois G. Dunn, Dover Publications, 1963
4. *Mechanics of Elastic Structures*, J. T. Oden and E. A. Ripperger, McGraw-Hill, 1981
5. *Smart Material Structures*: Modeling, Estimation and Control, H. T. Banks, R. C. Smith, Y. Wang, John Wiley & Sons, 1996
6. *Adaptive Structures*: Engineering Applications, David Wagg, Ian Bond, Paul Weaver and Michael Friswell (editors), John Wiley & Sons, 2007

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L	T/P/D	C
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(R17D7607) MODELING AND SIMULATION OF FLUID FLOWS (Elective-II)

UNIT-I: **BASIC EQUATIONS OF FLUID DYNAMICS AND DYNAMICAL LEVELS OF APPROXIMATION**
General form of a conservation law, Mass conservation equation, Momentum conservation law or equation of motion, Energy conservation equation; Navier–Stokes equations, Approximations of turbulent flows, Thin shear layer approximation, Parabolized Navier–Stokes equations, Boundary layer approximation, Distributed loss model, Inviscid flow model: Euler equations, Potential flow model.

UNIT II: **MATHEMATICAL NATURE OF THE FLOW EQUATIONS AND THEIR BOUNDARY CONDITIONS**
Simplified models of a convection–diffusion equation, Definition of the mathematical properties of a system of PDEs, Hyperbolic and parabolic equations: characteristic surfaces and domain of dependence, Time-dependent and conservation form of the PDEs, Initial and boundary conditions

UNIT III: DISCRETIZATION TECHNIQUES
Finite Difference Method for Structured Grids: Basics of finite difference methods, Multidimensional finite difference formulas, Finite difference formulas on non-uniform grids, General method for finite difference formulae, Implicit finite difference formulae; Finite Volume Method: Conservative discretization, Basis of finite volume method, Practical implementation of finite volume method; Introduction to Finite Element Method: Finite element definition of interpolation functions, Finite element definition of the equation discretization: integral formulation, Method of weighted residuals or weak formulation, Galerkin method, Finite element Galerkin method for a conservation law; Structured and Unstructured Grid Properties: Structured grids, Unstructured grids, Surface and volume estimations, Grid quality and best practice guidelines

UNIT IV: **ANALYSIS OF NUMERICAL SCHEMES**
Consistency, stability and error analysis of numerical schemes: Basic concepts and definitions, Von Neumann method for stability analysis, New Leapfrog, Lax-Fredrichs and Lax-Wendroff schemes for the linear convection equation, Spectral analysis of numerical errors; General Properties and High Resolution Numerical Schemes: General formulation of numerical schemes, Generation of new schemes with prescribed order of accuracy, Monotonicity of numerical schemes, Finite volume formulation of schemes and limiters

TIME INTEGRATION METHODS FOR SPACE DISCRETIZED EQUATIONS
Analysis of space-discretized systems, Analysis of time integration schemes, Selection of time integration methods, Implicit schemes for multidimensional problems: Approximate factorization method

UNIT V: **ITERATIVE METHODS FOR RESOLUTION OF ALGEBRAIC SYSTEMS**
Basic iterative methods, Overrelaxation methods, Preconditioning techniques, Nonlinear problems, Multigrid method.

NUMERICAL SIMULATION OF INVISCID FLOWS
Euler equations, Potential flow model, Numerical solutions for the potential equation, Finite

volume discretization of the Euler equations, Numerical solutions for the Euler equation
NUMERICAL SOLUTIONS OF VISCOUS LAMINAR FLOWS Navier-Stokes Equations for laminar flows, Density based methods for viscous flows, Numerical solutions with the density-based method, Pressure correction method, Numerical solutions with pressure correction method.

TEXT BOOK

1. *Numerical Computation of Internal and External Flows*, Second Edition, Charles Hirsch, Elsevier Publication, 2007

REFERENCE BOOKS

1. *Computational Fluid Dynamics: The Basics with Applications*, John David Anderson, McGraw Hill, 1995
2. Computational Fluid Mechanics and Heat Transfer, 2nd Edition, John C. Tannehill, Dale A. Anderson, Richard H. Pletcher, Taylor & Francis, 1997.

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(R17D7608) COMPUTATIONAL STRUCTURAL ANALYSIS
(Elective-II)

UNIT I: **STRUCTURAL MECHANICS-BASIC THEORY, STRUCTURAL MECHANICS-FINITE ELEMENTS**
Modeling of Material Behavior, Finite Element Formulation Based on the Stationary Functional Method,. One-Dimensional Line Elements, Two-Dimensional Plane Elements, Three-Dimensional Solid Elements, Isoparametric Quadrilateral and Hexahedron Elements, Torsion of Prismatic Shafts, Plate Bending Elements, Shell Elements, Areas of Analysis, Application of the Galerkin Method.

UNIT- II: **SPINNING STRUCTURES, DYNAMIC ELEMENT METHOD**
Derivation of Equation of Motion, Derivation of Nodal Centrifugal Forces, Derivation of Element Matrices; Bar Element, Beam Element, Rectangular Pre-stressed Membrane Element, Plane Triangular Element, Shell Element.

UNIT –III: **GENERATION OF SYSTEM MATRICES, SOLUTION OF SYSTEM EQUATIONS**
Coordinate Systems and Transformations, Matrix Assembly, Imposition of Deflection Boundary Conditions, Matrix Bandwidth Minimization, Sparse Matrix Storage Schemes; Formulation and Solution of System Equation, Sparse Cholesky Factorization.

UNIT –IV: **EIGENVALUE PROBLEMS, DYNAMIC RESPONSE OF ELASTIC STRUCTURES**
Free Vibration Analysis of Undamped Nonspinning Structures, Free Vibration Analysis of Spinning Structures, Quadratic Matrix Eigenvalue Problem for Free Vibration Analysis, Structural Stability Problems, Vibration of Prestressed Structures, Vibration of Damped Structural Systems, Solution of Damped Free Vibration Problem; Method of Modal Superposition, Direct Integration Methods, Frequency Response Method; Response to Random Excitation.

UNIT V

NONLINEAR ANALYSIS, STRESS COMPUTATIONS AND OPTIMIZATION
Geometric Nonlinearity, Material Nonlinearity, Numerical Examples; Line Elements, Triangular Shell Elements, Solid Elements, Optimization, Examples of Applications of Optimization.
HEAT TRANSFER ANALYSIS OF SOLIDS, COMPUTATIONAL LINEAR AEROELASTICITY AND AEROSERVOELASTICITY
Heat Conduction, Solution of System Equations, Numerical Examples, Coupled Heat Transfer and Structural Analysis.; Formulation of Numerical Procedure, Numerical Example
CFD-BASED AEROELASTICITY AND AEROSERVOELASTICITY
Computational Fluid Dynamics, Time-Marched Aeroe1astic and Aeroservoe1astic Analysis,
ARMA Model in Aeroelastic and Aeroservoelastic Analysis, Numerical Examples

TEXT BOOK

1. *Finite Element Multidisciplinary Analysis*, K.K.Gupta and J.L.Meek, Second Edition, AIAA, Education Series, 2003.

REFERENCE BOOK

1. *Finite Element Analysis – Theory and Application with ANSYS*, Saeed Moaveni, Second Edition, Prentice Hall, 2003

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(R17D7609) INTEGRATED AIRCRAFT SYSTEMS
(ELECTIVE-II)

UNIT – I: **AIRCRAFT SYSTEMS**

System - definition, examples, attributes – process, input, output, feedback, external influence. Systems engineering, application to engineering systems. Aircraft systems – principal components – airframe systems, vehicle (utility) systems, avionics systems, mission systems. Subsystems – purpose, description, safety aspects, integration, design drivers. The product life cycle – stages – the engineering processes.

UNIT – II: **AIRCRAFT HYDRAULIC SYSTEMS**

Hydraulic system services, the hydraulic circuit, actuation, the hydraulic fluid, hydraulic piping, hydraulic pump, fluid conditioning, the reservoir, emergency power sources. Aircraft applications, examples of B Ae, Airbus, Boeing implementations. The landing gear system for retraction, steering, braking and anti-skid.

ELECTRICAL SYSTEMS

Aircraft electrical system characteristics, power (AC and DC) generation, Power generation control, voltage regulation, parallel operation, supervisory and protection functions. Modern electrical power generation types, Electrical power quality. Primary power distribution, power conversion and energy storage. Secondary power distribution, power switching, load protection. Electrical loads, motors and actuators, lighting, heating, subsystem controllers, ground power. Emergency power generation. Typical civil transport aircraft electrical systems examples. Electrical load management system. Aircraft electrical wiring.

UNIT – III: **ENGINE CONTROL AND FUEL SYSTEMS**

The engine control problem, control system parameters, example systems, design criteria. Engine starting, air flow, fuel flow & ignition control, engine rotation, throttle levers, engine indications. Integrated flight and propulsion control.

Characteristics of aircraft fuel systems, fuel system components – fuel transfer pumps, fuel booster pumps, fuel transfer valves, non-return valves. Fuel quantity measurement systems. Fuel system operation modes - fuel pressurization, engine feed, fuel transfer, use of fuel as heat sink, external fuel tanks, fuel jettison, in-flight refueling. Integrated civil aircraft fuel systems.

PNEUMATIC SYSTEMS AND ENVIRONMENTAL CONTROL SYSTEMS.

Use of pneumatic power in aircraft, Sources of pneumatic power, the engine bleed air, engine bleed air control. Users of pneumatic power, wing and engine anti-ice, engine start, thrust reversers, hydraulic system, pitot-static systems.

The need for controlled environment in aircraft. Sources of heat. Environmental control system design, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control. Refrigeration systems, air cycle and vapour cycle systems, turbo fan, boot strap, reversed boot strap systems. Humidity control. Air distribution systems. Cabin pressurisation, g tolerance, rain dispersal, anti-misting and demisting. In-flight entertainment systems

UNIT – IV: **FLIGHT CONTROL SYSTEMS**

Principles of flight control, flight control surfaces, control surface actuation, flight control linkage systems, trim and feel. Power control, mechanical, direct drive, electromechanical, electro-hydrostatic actuation, multiple redundancy. The fly by wire system. Airbus and Boeing implementations, Inter-relationship of flight control, guidance and vehicle management systems.

Advanced systems - integrated flight and propulsion control, Vehicle management systems. All-electric aircraft concept, more-electric aircraft power generation concepts. Impact of stealth design- examples

SYSTEMS SAFETY, DESIGN AND DEVELOPMENT

Safety considerations – function, performance, integrity, reliability, dispatch availability, Economy considerations – maintainability, product support. Failure severity categorization, design assurance levels. Integration of aircraft systems

Systems design, specifications and requirement, regulations. Design guidelines and certification techniques. Safety assessment processes - functional hazard analysis, preliminary systems safety analysis, systems safety analysis, common cause analysis. Requirements capture. Fault tree analysis, failure modes and effects analysis, component reliability, dispatch reliability, Markov analysis.

UNIT – V: **SYSTEMS ARCHITECTURE, INTEGRATION**

Architectural representation of systems, merits, definitions, types, architecture modeling and trade-off. Systems integration, definitions, levels of integration, examples, management o f systems integration. Aircraft system example

Verification of system requirements, tools - modeling, simulation, test rigs and prototypes, Modeling techniques - types of models and simulations. Test rigs and prototypes. Declaring verification.

Need for interoperability of evolving systems. Forward compatibility and backward compatibility, Factors affecting compatibility. System configurations. representation. configuration control – need, the process.

TEXT BOOKS

1. *Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration*, Moir, I. and Seabridge, A., AIAA Education Series, AIAA, 2001, ISBN: 1-56347506-5
2. *Design and Development of Aircraft Systems – An Introduction*, Moir, I., and Seabridge, A., AIAA Education Series, AIAA, 2004, ISBN: 1-56347-722-X.
3. *Civil Avionics Systems*, Moir, I. and Seabridge, A., AIAA Education Series, AIAA, 2002, ISBN 1-56347589-8

REFERENCE BOOKS

1. *Ground Studies for Pilots: Flight Instruments and Automatic Flight Control Systems*, Harris, D., sixth edition, Blackwell Science, 2004, ISBN 0-632-05951-6.
2. *Aircraft Electrical Systems*, Pallet, E. H. J., Indian Edition, The English Book Store, New Delhi, 1993, ISBN81-70002-059-X
3. *Pneumatic and Hydraulic Systems*, Bolton, W.,Butterworth Heinemann.
4. *Aircraft Instruments & Integrated Systems*, Pallett, E.H.J., Longman Scientific & Technical, 1996.

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(R17DEC51) EMBEDDED SYSTEMS PROGRAMMING
(OPEN ELECTIVE –I)

Unit 1 - Embedded OS (Linux) Internals
Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication - Semaphore, Pipes, FIFO, Shared Memory
Kernel: Structure, Kernel Module Programming Schedulers and types of scheduling.
Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network
Unit 2 – Open source RTOS
Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS, Scheduling Systems, Inter-process communication, Performance Matric in scheduling models, Interrupt management in RTOS environment, Memory management, File systems, I/O Systems, Advantage and disadvantage of RTOS.
Unit 3 – Open Source RTOS Issues
POSIX standards, RTOS Issues - Selecting a Real Time Operating System, RTOS comparative study. Converting a normal Linux kernel to real time kernel, Xenomai basics.
Overview of Open source RTOS for Embedded systems (Free RTOS/ Chibios-RT) and application development.
Unit 4 – VxWorks / Free RTOS
VxWorks/ Free RTOS Scheduling and Task Management - Realtime scheduling, Task Creation, Intertask Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts I/O Systems - General Architecture, Device Driver Studies, Driver Module explanation, Implementation of Device Driver for a peripheral
Unit 5 – Case study
Cross compilers, debugging Techniques, Creation of binaries & porting stages for Embedded Development board (Beagle Bone Black, Rpi or similar), Porting an Embedded OS/ RTOS to a target board ().Testing a real time application on the board

TEXT BOOKS:
1. Essential Linux Device Drivers, Venkateswaran Sreekrishnan
2. Writing Linux Device Drivers: A Guide with Exercises, J. Cooperstein
3. Real Time Concepts for Embedded Systems – Qing Li, Elsevier
REFERENCES:
1. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3. Software Design for Real-Time Systems: Cooling, J E Proceedings of 17the IEEE Real-Time Systems Symposium December 4-6, 1996 Washington, DC: IEEE Computer Society
4. Real-time Systems – Jane Liu, PH 2000
5. Real-Time Systems Design and Analysis : An Engineer's Handbook: Laplante, Phillip A

6. Structured Development for Real - Time Systems V1 : Introduction and Tools: Ward, Paul T & Mellor, Stephen J
7. Structured Development for Real - Time Systems V2 : Essential Modeling Techniques: Ward, Paul T & Mellor, Stephen J
8. Structured Development for Real - Time Systems V3 : Implementation Modeling Techniques: Ward, Paul T & Mellor, Stephen J
9. Monitoring and Debugging of Distributed Real-Time Systems: TSAI, Jeffrey J P & Yang, J H
10. Embedded Software Primer: Simon, David E.
11. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw
Hill

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(R17DCS51) SCRIPTING LANGUAGES
(OPEN ELECTIVE – I)

UNIT I

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL-Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance perl - finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT II

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Datatypes, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III

Advanced PHP Programming Php and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World – Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text, Generate Binary Files, Set the desired language within your scripts, Localizing Dates, Numbers and Times.

UNIT IV

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk- Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

UNIT V

Python Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dreamtech)

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
2. Programming Python, M.Lutz, SPD.
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah, The X Team, SPD.
5. Core Python Programming, Chun, Pearson Education.

6. Guide to Programming with Python, M.Dawson, Cengage Learning.
7. Perl by Example, E.Quigley, Pearson Education.
8. Programming Perl, Larry Wall, T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
10. PHP and MySQL by Example, E.Quigley, Prentice Hall(Pearson).
11. Perl Power, J.P.Flynt, Cengage Learning.
12. PHP Programming solutions, V.Vaswani, TMH.

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(R17DME51) NON CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE-I)

UNIT-I

Introduction: Energy Scenario, Survey of energy resources. Classification and need for conventional energy resources.

Solar Energy: The Sun-sun-Earth relationship, Basic matter to waste heat energy circuit, Solar Radiation, Attention, Radiation measuring instruments.

Solar Energy Applications: Solar water heating. Space heating, Active and passive heating, Energy storage, Selective surface, Solar stills and ponds, solar refrigeration, Photovoltaic generation.

UNIT -II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

Direct Energy Conversion: Nuclear Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic, Thermionic and Thermoelectric generation and MHD generator.

Hydrogen Gas as Fuel: Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT-IV

Bioenergy: Biomass energy sources. Plant productivity, Biomass wastes, aerobic and anaerobic bioconversion processes, Raw material and properties of bio-gas, Bio-gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching Electricity generation.

Energy from Oceans: Tidal energy, Tides, Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

TEXTBOOKS:

1.Non-conventional Energy Sources / GD Rai/Khanna publications.
2.Non-Conventional Energy Sources and Utilisation (Energy Engineering)/ R KRajput/ S.Chand.
3.Renewable Energy Sources /Twidell & Weir/Taylor and Francis/ 2nd special Indian edition .

REFERENCE BOOKS:

1.Renewable Energy Resources- Basic Principles and Applications/ G.N.Tiwari and M.K.GhosalNarosa Publications.
2.Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition.
3.Non Conventional Energy / K.Mittal/ Wheeler.

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(R17DAE51) MATHEMATICAL MODELING TECHNIQUES
(OPEN ELECTIVE-I)

UNIT-I: **INTRODUCTION TO MODELING AND SINGULAR PERTURBATION METHODS**
Definition of a model, Procedure of modeling: problem identification, model formulation, reduction, analysis, Computation, model validation, Choosing the model, Singular Perturbations: Elementary boundary layer theory, Matched asymptotic expansions, Inner layers, nonlinear oscillations

UNIT-II: **VARIATIONAL PRINCIPLES AND RANDOM SYSTEMS**
Variational calculus: Euler's equation, Integrals and missing variables, Constraints and Lagrange multipliers, Variational problems: Optics-Fermat's principle, Analytical mechanics: Hamilton's principle, Symmetry: Noether's theorem, Rigid body motion, Random systems: Random variables, Stochastic processes, Monte Carlo method

UNIT-III: **FINITE DIFFERENCES: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**
ODE: Numerical approximations, Runge-Kutta methods, Beyond Runge-Kutta, PDE: Hyperbolic equations-waves, Parabolic equations-diffusion, Elliptic equations-boundary values
CELLULAR AUTOMATA AND LATTICE GASES
Lattice gases and fluids, Cellular automata and computing

UNIT- IV: **FUNCTION FITTING AND TRANSFORMS**
Function fitting: Model estimation, Least squares, Linear least squares: Singular value decomposition, Non-linear least squares: Levenberg-Marquardt method, Estimation, Fisher information, and Cramer-Rao inequality, Transforms:Orthogonal transforms, Fourier transforms, Wavelets, Principal components
FUNCTION FITTING ARCHITECTURES
Polynomials: Pade approximants, Splines, Orthogonal functions, Radial basis functions, Over-fitting, Neural networks: Back propagation, Regularization

UNIT-V: **OPTIMIZATION AND SEARCH**
Multidimensional search, Local minima, Simulated annealing, Genetic algorithms
FILTERING AND STATE ESTIMATION
Matched filters, Wiener filters, Kalman filters, Non-linearity and entrainment, Hidden Markov models

TEXT BOOK

1. *The Nature of Mathematical Modeling*, Neil Gershenfeld, Cambridge University Press, 2006, ISBN 0-521-57095-6

REFERENCE BOOKS

1. *Mathematical Models in the Applied Sciences*, A. C. Fowler, Cambridge University Press, 1997, ISBN 0-521-46140-5
2. *A First Course in Mathematical Modeling*, F. R. Giordano, M.D. Weir and W.P. Fox, 2003, Thomson, Brooks/Cole Publishers

3. *Applied Numerical Modeling for Engineers*, Donald De Cogan, Anne De Cogan, Oxford University Press, 1997

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(R17D7681) DIGITAL SIMULATION LAB – I

I. MATLAB/ SIMULINK FUNDAMENTALS FOR AEROSPACE APPLICATIONS

MATLAB introduction, Plotting and graphics: Plot, log and semi-log plots, polar plots,Subplots, axis, mesh, contour diagrams, flow diagrams, movies, MATLAB Toolboxes: Continuous transfer functions, root locus, Nichols chart, Nyquist chart, linear quadratic regulator, state-space design, digital design, Aerospace toolbox; M Cells, Structures and M-files, MEX-files,

Standard Simulink libraries, Simulink aerospace blockset, Building Simulink linear models: transfer function modeling in Simulink, zero pole model, state-space model; Simulink LTI viewer and usage of it, equivalent Simulink LTI models, Single-Input, Single-Output(SISO) design tool, Building Multi-Input, Multi –Output models, Building Simulink S-functions; Stateflow introduction: Opening, executing, and saving stateflow models, constructing a simple stateflow model, using a stateflow truth table

II. SOFTWARE DEVELOPMENT FOR SIMULATION OF FLUID FLOWS

1. Generation of structured and unstructured grids in two and three dimensions
2. Solution of Burgers equation using explicit MacCormack method
3. Blasius solution for laminar boundary layer over a flat

III. FLOW SIMULATION

Simulation of Flow past airfoils and wings
Simulation of Compressible flow in convergent-divergent nozzle
Simulation of compressible flow in a compressor

REFERENCES

1. *Basic MATLAB, Simulink, and State Flow, Richard Colgren*, AIAA Education Series, 2007
2. *Introduction to Simulink with Engineering Applications*, Steven T. Karris, Orchard Publications, 2006, ISBN –9744239-8-X
3. *Computational Fluid Mechanics and Heat Transfer,* Second Edition, John C. Tannehill, Dale A. Anderson, Richard H. Pletcher, Taylor & Francis Publication, 1997.
4. *Computational Fluid Dynamics,* T. J. Chung, Cambridge University Press, 2002

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(R17D7610) AIRCRAFT CONTROL AND SIMULATION

UNIT-I: **THE KINEMATICS AND DYNAMICS OF AIRCRAFT MOTION**
Vector Kinematics, Matrix Analysis of Kinematics, Geodesy, Earth's Gravitation, Terrestrial Navigation, Rigid-Body Dynamics.

UNIT-II: **MODELING THE AIRCRAFT**
Basic Aerodynamics, Aircraft Forces and Moments, Static Analysis, The Nonlinear Aircraft Model, Linear Models and the Stability Derivatives.
MODELING, DESIGN AND SIMULATION TOOLS
State Space Models, Transfer Function Models, Numerical Solution of the State Equations, Aircraft Models for Simulation, Steady State Flight, Numerical Linearization, Feedback control, Aircraft dynamic behavior.

UNIT-III: **AIRCRAFT DYNAMICS AND CLASSICAL CONTROL DESIGN**
Aircraft Rigid Body Modes, The Handling Qualities Requirements, Stability Augmentation Systems, control augmentation system, auto pilots and Nonlinear Simulation.

UNIT-IV: **MODERN DESIGN TECHNIQUES**
Assignment of Closed-Loop Dynamics, Linear Quadratic Regulator with Output Feedback, Tracking a Command, Modifying the Performance Index, Model Following Design, Linear Quadratic Design with Full State Feedback, Dynamic Inversion Design.

UNIT-V: **ROBUSTNESS AND MULTIVARIABLE FREQUENCY DOMAIN TECHNIQUES**
Multivariable Frequency Domain Analysis, Robust Output Feedback Design, Observers and the Kalman Filter.
DIGITAL CONTROL
Simulation of Digital Controllers, Discretization of Continuous Controllers, Modified Continuous Design, Implementation Considerations.

TEXT BOOK

1. *Aircraft Control and Simulation,* Brian L. Stevens and Frank L. Lewis, John Wiley & Sons, 2003

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(R17D7611) AEROSPACE SENSORS AND MEASUREMENT SYSTEMS

UNIT-I: **INTRODUCTION TO EXPERIMENTAL METHODS**
Characteristics of Measuring systems:: Readability, Sensitivity, Hysteresis, Accuracy, Precision: Calibration, Standards, Experiment planning, Causes and types of experimental errors, Statistical analysis of experimental data

UNIT II: **FLOW MEASUREMENTS**
Pressure Measurement: Manometer, Pressure transducers, Scanning valves; Temperature Measurement: Thermometers, Thermocouples, Thermopiles, Keil probes; Velocity Measurement: Pitot probes, Hot wires, 7 hole probes, Laser Doppler Velocimetry (LDV), Particle Image Velocimetry (PIV), Doppler Global Velocimetry(DGV) ; Turbulence Measurements: LDV, Hot wire anemometers, Root Mean Square(RMS), Spectrum;
FLOW VISUALIZATION
Path-, Streak-, Stream-, and Time lines, Direct visualization, Surface flow visualization, Flow field visualization, Data driven visualization

UNIT-III: **FORCES AND MOMENTS FROM WIND TUNNEL BALANCE MEASUREMENTS:** Types of wind tunnels, Aeronautical wind tunnels, Wind tunnel data systems, Balances, Balance requirements and specifications, External balances and internal balances
STRESS AND STRAIN MEASUREMENTS
Stress and strain, Strain measurements, Strain gauge types, Basic characteristics of of a strain gage, Electrical resistance strain gauges, Rosette analysis, Strain gauge sensitivity, Stress gauges

UNIT IV: **MOTION AND VIBRATION MEASUREMENT**
Two simple vibration instruments, Principles of seismic instrument, Practical considerations for seismic instruments, Sound measurements
MOTION AND INERTIAL MEASUREMENTS
Applications of accelerometer sensors, Acceleration sensing principles, Pendulous accelerometer (open and closed loop), Micro-machined accelerometer, Piezoelectric accelerometer, Rate gyroscope principles, Rate-integrating gyroscope principles, Micro-gyro sensors, Laser gyros

UNIT-V: **SPACECRAFT ATTITUDE DETERMINATION SENSORS**
Infrared earth sensors-Horizon Crossing Sensors, Sun sensors, Star sensors, Rate and rate integrating gyros, Magnetometers

TEXT BOOKS

1. *Experimental Methods for Engineers,* Seventh Edition, J. P. Holman, Tata McGraw Hill, 2004
2. *Measurement Systems-Application and Design,*5th Edition, Ernest O Doebelin, Dhanesh N Manik, Tata McGraw Hill, 2007
3. *Low-Speed Wind Tunnel Testing,* Jewel B Barlow, William H. Rae,Jr. , Alan Pope, John Wiley, Third Edition, 1999

4. *Spacecraft Dynamics and Control-A Practical Engineering Approach,* Marcel J. Sidi, Cambridge University Press, 1997

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(R17D7612) COMPUTATIONAL APPROACHES TO AEROSPACE VEHICLE DESIGN

UNIT-I: **PRINCIPLES OF AEROSPACE DESIGN**
Historical Perspective on aerospace design, Traditional manual approaches to design and design iteration, Design teams, Advances in modeling techniques, Tradeoffs in aerospace system design, Design automation, evolution and innovation, Design search and optimization, Take-up of computational methods, Design oriented Analysis: Geometry modeling and design parameterization, Computational mesh generalization, Analysis and design of coupled systems

UNIT-II: **ELEMENTS OF NUMERICAL OPTIMIZATION-I**
Single variable optimizers- line search, Multi variable optimizers: Population versus single point methods, Gradient based methods, Noisy/Approximate function values, Non-gradient based algorithms, Termination and convergence aspects, Constrained optimization, Problem transformations, Lagrange multipliers, Feasible directions method, Penalty function methods, Combined Lagrangian and penalty function methods, Sequential quadratic programming, Chromosome repair

UNIT-III: **ELEMENTS OF NUMERICAL OPTIMIZATION-II**
Meta models and Response surface methods: Global versus local meta models, Meta modeling tools, Simple RSM examples, Combined approaches-Hybrid searches and meta heuristics, Multi-objective optimization, Multi-objective weight assignment techniques, Methods for combining goal functions, fuzzy logic and physical programming, Pareto set algorithms
Sensitivity Analysis: Finite-difference methods, Complex variable approach, Direct methods, Adjoint mehods, Semi-analytical methods, Automatic differentiation

UNIT-IV: **APPROXIMATION CONCEPTS**
Local approximations, Multipoint approximations, Black-box modeling, Generalized linear models, Sparse approximations techniques, Gaussian process interpolation and regression, Data parallel modeling, Design of experiments, Surrogate modeling using variable fidelity models, Reduced basis methods
DESIGN SPACE EXPLORATION-SURROGATE MODELS
Managing surrogate models in optimization: Trust regions, Space mapping approach, Surrogate assisted optimization using global models, Managing surrogate models in evolutionary algorithms

UNIT-V: **DESIGN IN THE PRESNCE OF UNCERTAINTY**
Uncertainty modeling and representation, Uncertainty propagation, Taguchi methods, Welch-Sacks method, Design for six sigma, decision theoretic formulations, Reliability-based optimization, Robust design using information-gap theory, Evolutionary algorithms for robust design

MULTI-DISCIPLINARY OPTIMIZATION
Multi-disciplinary analysis, Fully integrated optimization, System decomposition and optimization, Simultaneous analysis and design, Distributed analysis optimization formulation, Collaborative optimization, Concurrent subspace optimization, Co-evolutionary architectures

TEXT BOOK

1. *Computational Approaches for Aerospace Design-The Pursuit of Excellence*, Andy J. Keane, Prasanth B. Nair, John Wiley & Sons, 2005, ISBN 10:0-470-85540-1

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(R17D7613) AEROTHERMODYNAMICS OF HYPERSONIC FLIGHT
(ELECTIVE-III)

UNIT I: **GENERAL CHARACTERIZATION OF HYPERSONIC FLOWS**

Defining hypersonic flow, Characterizing hypersonic flow using fluid dynamicphenomenon. Basic Equations of Motion**:** Equilibrium and non-equilibrium flows, Equilibrium conditions, Dependent variables, Transport properties, Continuity, momentum and energy equations, General form of the equations of motion in conservation form.

UNIT II: **DEFINING THE AEROTHERMODYNAMIC ENVIRONMENT**

Empirical correlations complemented by analytical techniques, General comments about CFD, Computations based on a two layer flow model, Techniques treating entire shock layer in a unified fashion, Calibration and validation of the CFD codes

EXPERIMENTAL MEASUREMENTS OF HYPERSONIC FLOWS

Ground-based simulation of hypersonic flows, Ground-based hypersonic facilities, Experimental data and model design considerations, Flight tests, Importance of interrelating CFD, ground-test data and flight-test data

UNIT III: **STAGNATION-REGION FLOW FIELD**

Stagnating streamline, Stagnation-point convective heat transfer, Radiative heat flux

PRESSURE DISTRIBUTION:

Newtonian flow models, Departure from the Newtonian flow field, Shock-Wave / Boundary Layer (Viscous) Interaction for two-dimensional compression Ramps, Tangent-Cone and Tangent-Wedge approximations, Need for more sophisticated models, Pressure distributions for a reacting gas, Pressures in separated regions

UNIT IV: **BOUNDARY LAYER AND CONVECTIVE HEAT TRANSFER**

Boundary Conditions, Metric or equivalent cross-section radius, Convective heat transfer and skin friction, Effects of surface catalycity, Base heat transfer in separated flow

VISCOUS INTERACTIONS:

Compression ramp flows, Shock/Shock interactions, Flow field perturbations around swept fins, Corner flows, Examples of Viscous Interactions for Hypersonic Vehicles: X-15, Space shuttle orbiter, Hypersonic air-breathing aircraft

UNIT V: **AERODYNAMIC FORCES AND MOMENTS & DESIGN CONSIDERATIONS OF HYPERSONIC VEHICLES**

Newtonian Aerodynamic Coefficients, Re-entry capsule aerodynamics, Shuttle orbiter aerodynamics, X-15 Aerodynamics, Hypersonic aerodynamics of research plane, Dynamic stability considerations; Design Considerations: Reentry vehicles, Design philosophy, Design considerations for rocket-launched/glide reentry vehicles, airbreathing vehicles, combined rocket/airbreathing powered vehicles, Design of a new vehicle

TEXTBOOK

1. *Hypersonic Aerothermodynamics*, John J. Bertin, AIAA Education Series, 1994.

REFERENCE BOOKS

1. *Hypersonic and High Temperature Gas Dynamics*, Second Edition, J. D. Anderson, AIAA Eucation Series, 2006
2. *Basics of Aerothermodynamics*, Ernst Heinrich Hirshchel, Springer-Verlag, 2005

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(R17D7614) ADVANCED TOPICS IN AIR TRAFFIC MANAGEMENT SYSTEMS (ELECTIVE-III)

UNIT- I: **AIR TRAFFIC MANAGEMENT**

Introduction: Air traffic services provided to aircraft operators, Government responsibilities, Flight rules and airspace organization, Airways and procedures, Phases of flight, Subsystems of ATM system, Facilities and operation, System capacity, Airborne collision avoidance systems, Future trends, Capacity driven operational concept of ATM.

UNIT-II: **ECONOMICS OF CONGESTION**

Impact of ATM on airspace user economic performance, Effects of schedule disruptions on the economics of airline operations, modeling of an airline operations control center.

COLLABORATIVE DECISION MAKING

Effect of shared information on pilot controller and controller- controller interactions, Modeling of distributed human decision making in traffic flow management operations.

UNIT-III: **AIRPORT OPERATIONS AND CONSTRAINTS**

Analysis, modeling and control of ground operations at airports, Collaborative optimization of arrival and departure traffic flow management strategies at airports.

AIRSPACE OPERATIONS AND CONSTRAINTS

Performance measures of air traffic services, Identification of airport and airspace capacity constraints.

UNIT-IV: **SAFETY AND FREE FLIGHT**

Accident risk assessment for advanced air traffic management, Airborne separation assurance systems. Human factors

COGNITIVE WORKLOAD ANALYSIS AND ROLE OF AIR TRAFFIC CONTROLLER: Task load measures of air traffic controllers, Technology enabled shift in controller roles and responsibilities.

UNIT-V: **AIRCRAFT SELF SEPARATION**

Cooperative optimal airborne separation assurance in free flight airspace, Automatic dependent surveillance broadcast system - operational evaluation.

TEXT BOOKS

1. *Fundamentals of Air Traffic Control*, Fourth edition, Nolan, M.S., Thomson Learning, 2004, ISBN-13:978-0-534-39388-5.
2. *Air Transportation Systems Engineering*, Donohue, G. L. et al., (Editors), AIAA, 20003, ISBN 1-56347-474-3
3. *Avionics Navigation Systems*, Keyton, M. and Fried, W. R., John Wiley, 2001, ISBN 0-471-54795-6

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(R17D7615) SPACECRAFT DYNAMICS AND CONTROL
(ELECTIVE-III)

UNIT-I: **ORBIT DYNAMICS**
Basic physical principles, Two body problem, Moment of momentum, Equation of motion of a particle in a central force field, Time and Keplerian orbits, Keplerian orbits in space, Perturbed orbits: Non-Keplerian orbits, Perturbing forces and their influence on the orbit, Perturbed geostationary orbits, Euler – Hill equations.

UNIT-II: **ORBITAL MANEUVERS**
Single-impulse orbit adjustment., Multiple-impulse orbit adjustment, Geostationary orbits, Geostationary orbit corrections .
ATTITUDE DYNAMICS AND KINEMATICS
Angular momentum and inertia matrix, Rotational kinetic energy of a rigid body, Moment of inertia matrix in selected axis frame, Euler's moment equations, Characteristics of rotational motion of a spinning body, Attitude kinematics equations of motion of a spinning body, Attitude dynamic equations of motion for a nonspinning satellite

UNIT-III: **GRAVITY GRADIENT STANILIZATION**
Basic attitude control equation, Gravity gradient attitude control
SINGLE- AND DUAL-SPIN STABILIZATION
Attitude stabilization during the ΔV stage, Active nutation control,
Estimation of fuel consumed during active nutation control, Despinning and denutation of a satellite, Single spin stabilization, dual spin stabilization

UNIT-IV: **ATTITUDE MANEUVERS IN SPACE**
Equations for basic control laws, Control with momentum exchange devices, Magnetic attitude control, Magnetic unloading of momentum exchange devices, Time-optimal attitude control, Technical features of the reaction wheel.
MOMENTUM-BIASED ATTITUDE STABILIZATION
Stabilization with and without active controls, Roll-yaw attitude control with two momentum wheels, Reaction thruster attitude control

UNIT-V: **REACTION THRUSTER ATTITUDE CONTROL**
Set up of reaction thruster control, Reaction torques and attitude control loops, feed back control loops, Reaction attitude control via pulse width modulation, Reaction control system using only four thrusters, Reaction control and structural dynamics.

TEXT BOOK

1. *Spacecraft Dynamics and Control*, Marcel J. Sidi, Cambridge University Press, 1997

REFERENCES

1. *Modern Spacecraft Dynamics & Control*, M. H. Kaplan, Wiley, 1976,

2. *Space Vehicle Dynamics and Control*., B. Wie, AIAA, 1998
3. *Spacecraft Attitude Determination and Control*, J. R. Wertz, editor, D. Reidel Publishing, 1978

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(R17D7616) COMMUNICATION, NAVIGATION AND SURVEILLANCE SYSTEMS (ELECTIVE-IV)

UNIT-I: **ROLE OF NAVIGATION IN FLIGHT VEHICLE MISSION - NAVIGATION SYSTEMS**
Introduction: Definitions of navigation and surveillance, Guidance versus navigation, Categories of navigation, Civil and military aircraft, Phases of flight,, Evolution of avionics, Human navigator; Navigation Equations: Geometry of the Earth, Coordinate frames, Dead-reckoning computations, DR Positioning computing, Terrain-matching navigation, Course computation, Navigation errors, Digital charts, Software development

UNIT-II: **TERRESTRIAL-RADIO-NAVIGATION SYSTEMS**
General principles, System design considerations, Point source systems, hyperbolic systems
SATELLITE RADIO NAVIGATION: System configuration, Basics of satellite radio navigation, Orbital mechanics and clock characteristics, Atmospheric effects on satellite signals, NAVSTAR Global Positioning System, Global Orbiting Navigation Satellite System(GLONASS), GNSS integrity and availability

UNIT-III: **INERTIAL NAVIGATION**
Principles of Inertial navigation system, alignment Instruments, Platforms, Mechanization equations, **INS** Errors and Mixed systems, Alignment, Fundamental limits
AIR-DATA INSTRUMENTS & SYSTEMS, ATTITUDE AND HEADING REFERENCES
Air-Data Systems: Air-data measurements, Air-data equations, Air-data systems, Specialty designs, Calibration and system test; Attitude and Heading References: Basic instruments, Vertical references, Heading-direct indicating compass and direction indicators, gyro magnetic compass horizontal simulation indicators, altitude- and alignment –Datum compasess,magnetic compass deviation, compass switching procedures

UNIT-IV: **DOPPLER AND ALTIMETER RADARS, LANDING SYSTEMS**
Doppler Radars: Functions and applications, Doppler radar principles and design approaches, Signal characteristics, Doppler radar errors, Equipment configurations, Radar Altimeters: Functions and applications, General principles, Pulsed radar altimeters, FM-CW radar altimeter, Phase-coded pulsed radar altimeters; Landing Systems: Low-visibility operations, Mechanics of landing, Automatic landing systems, Instrument landing systems, Microwave-landing system, Satellite landing systems, Carrier landing systems,

UNIT-V: **MULTISENSOR INTEGRATED NAVIGATION SYSTEMS**
Inertial system characteristics, Integrated stellar-inertial systems, Integrated Doppler- inertial systems, Airspeed-damped inertial system, Integrated stellar-inertial-doppler system, Position update of an inertial system, Noninertial GPS multisensor navigation systems, Filtering of measurements, Kalman filter basics, Open-loop and closed loop Kalman filter mechanizations, GPS-INS mechanization, Practical considerations, Federated system architecture
AIR TRAFFIC MANAGEMENT

Services provided to aircraft carriers, Government responsibilities, Flight rules and airspace organization, Airways and procedures, Phases of flight, Subsystems, Facilities and operations, System capacity, Airborne Collision Avoidance Systems

TEXT BOOKS

1. *Avionics Navigation Systems,* Second Edition, Myron Kayton and Walter R.Freid, John Wiley & Sons, Inc, 1997, ISBN 0-471-54795-6
2. *Civil Avionics Systems,* Moir, I and Seabridge, A, AIAA Education Series, AIAA, 2002, ISBN 1-56347589-8

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(R17D7617) SPACE TRANSPORTATION SYSTEMS
(ELECTIVE-IV)

UNIT-I: **INDIAN SPACE TRANSPORTATION SYSTEM DEVELOPMENT**
Introduction, Systems engineering definition, System engineer, Systems engineering cycle, Systems engineering process, Doctrine of successive refinement, Tools and methodologies, Systems analysis, Modeling, and the trade study process, Basic launch vehicle system trade analysis methodology, System effective studies.

Evolution of ISRO, organization and structure of ISRO, Goals, objectives, evolution of Indian carrier rockets-PSLV, GSLV, Chandrayan, Mangalyan

UNIT II: **TRANSPORTATION SYSTEM ARCHITECTURE, INFRASTRUCTURES AND U.S. SPACE SHUTTLE**
Introduction, Historical drivers for space infrastructure, Political considerations, National mission model, Private sector and commercialization, Development of commercial space transportation architecture and system concepts, Cost drivers for space transportation architecture options, Recommended improvements to space transportation architectures, Planning for future space infrastructure, Transportation Infrastructure for moon and mars missions U.S. Space Shuttle: Introduction, Historical background, Development of shuttle system, Orbiter development, Current shuttle vehicle and operations, Shuttle evolution and future growth,

UNIT-III: **EXPENDABLE SPACE TRANSPORTATION SYSTEMS AND REUSABLE SPACE LAUNCH VEHICLES**
Introduction, Expendable launch vehicle design, History behind existing Expendable Launch Vehicles, Evolving the expendable launch vehicle, Reusable space launch vehicles: Background—Previous efforts at hypersonic flight, Early aerospace plane conceptual studies, The X-series of research aircraft, Challenges facing manned aerospace planes, Manned reusable systems development programs-Past and Ongoing., NASA reusable launch vehicle studies in 1990s., Hypersonic waveriders, Importance of vehicle health management, Future reusable space launch vehicles

OPERATIONS AND SUPPORT SYSTEMS
Introduction, Launch operations definition, Shuttle mission operations, Facility requirements for launch operations, Obstacles to streamlining launch operations, Evolutionary launch operations strategies, Designing for future expendable launch vehicle launch operations, Improving Existing Launch Operations, Future launch operations

UNIT IV: SYSTEMS AND MULTIDISCIPLINARY DESIGN OPTIMIZATION
Introduction, Launch vehicle conceptual design problem, Modeling needs, Optimization strategies and applications, Collaborative work environment of the future

SYSTEMS TECHNOLOGY DEVELOPMENT
Introduction, Vehicle technologies, Propulsion technologies, Ground and mission operations technologies, Assessing technological options, Technology transfer and commercialization, Applying a commercial development process for access to space

UNIT V: PROGRAM PLANNING, MANAGEMENT, AND EVALUATION

Introduction, Management Trends, Good Project Management as Team Building and a Balancing Act, Types of Project Management, Configuration Management, Risk Management, Earned value management, Total Quality Management, Managing ultra-large projects

FUTURE SYSTEMS

Introduction, Next generation space transportation systems, Accelerator concepts, nuclear fission and fusion based concepts, Antimatter-based propulsion concepts, Solar propulsion concepts, Laser and beamed energy propulsion Concepts, Magnetic Monopoles Concept, Field and Quantum Effect Propulsion Concepts.

Text Book

1. ***S****pace Transportation: A Systems Approach to Analysis and Design***,** Walter Hammond, AIAA Education Series, American Institute of Aeronautics and Astronautics, Inc, 1999.

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(R17D7618) DYNAMICS AND CONTROL OF STRUCTURES
(ELECTIVE-IV)

UNIT-I: **NEWTONIAN MECHANICS**
Newton's Second Law, Impulse and Momentum, Moment of a Force and Angular Momentum, Work and Energy, Systems of Particles, Rigid Bodies, Euler's Moment Equations.

UNIT-II: **PRINCIPLES OF ANALYTICAL MECHANICS**
Degree of Freedom and Generalized Coordinates, The Principle of Virtual Work, D'Alembert's Principle, Hamilton's Principle, Lagrange's Equations of Motion, Hamilton's Canonical Equations, Motion in the Phase Space, Lagrange's Equations of Motion in Terms of Quasi-Coordinates.
CONCEPTS FROM LINEAR SYSTEM THEORY
Concepts from System Analysis, Frequency Response, Response by Transform Methods, The Transfer Function, Singularity Functions, Response to Singularity Functions, Response to Arbitrary Excitation, The Convolution Integral, State Equations. Linearization about Equilibrium, Stability of Equilibrium Points , Response by the Transition Matrix, Computation of the Transition Matrix, The Eigen value Problem, Response by Modal Analysis, State Controllability, Output Equations, Observability, Sensitivity of the Eigen solution to Changes in the System Parameters, Discrete-Time Systems.

UNIT-III: **LUMPED-PARAMETER STRUCTURES**
Equations of Motion for Lumped-Parameter Structures, Energy Considerations, The Algebraic Eigen value Problem, Free Response, Qualitative Behavior of the Eigen solution, Computational Methods for the Eigen solution, Modal Analysis for the Response of Open-Loop Systems.
CONTROL OF LUMPED-PARAMETER SYSTEMS. CLASSICAL APPROACH
Feedback Control Systems, Performance of Control Systems, The Root-Locus Method, The Nyquist Method, Frequency Response Plots, Bode Diagrams, Relative Stability. Gain Margin and Phase Margin, Log Magnitude-Phase Diagrams, The Closed-Loop Frequency Response. Nichols Charts, Sensitivity of Control Systems to Variations in Parameters, Compensators, Solution of the State Equations by the Laplace Transformation

UNIT-IV: **CONTROL OF LUMPED-PARAMETER SYSTEMS. MODERN APPROACH**
Feedback Control Systems, Pole Allocation Method, Optimal Control, The Linear Regulator Problem, Algorithms for Solving the Riccati Equation, The Linear Tracking Problem, Pontryagin's Minimum Principle, Minimum-Time Problems, Minimum-Time Control of Time-Invariant Systems Minimum-Fuel Problems, Simplified On-Off Control, Control Using Observers, Optimal Observers. The Kalman-Bucy Filter, Direct Output Feedback Control, Modal Control

UNIT-V: **DISTRIBUTED-PARAMETER STRUCTURES, EXACT AND APPROXIMATE METHODS**
BOUNDARY-Value Problems, The Differential Eigen value Problems, Rayleigh's Quotient, The Rayleigh-Ritz Method, The Finite Element Method, The Method of Weighted Residuals; Substructure of Un damped Structures, Damped Structures.
CONTROL OF DISTRIBUTED STRUCTURES

Closed-Loop Partial Differential Equation of Motion, Modal Equations for Un damped Structures, Mode Controllability and Observability, Closed-Loop Modal Equations, Independent Modal-Space Control, Coupled Control, Direct Output Feedback Control,
Systems with Proportional Damping, Control of Discretized Structures, Structures with General Viscous Damping.

TEXT BOOK

1. *Dynamics and Control of Structures*, Leonard Meirovitch, John Wiley & Sons, 1990

REFERENCE BOOKS

1. *Introduction to Structural Dynamics and Aeroelasticity*, Dewey. H. Hodges, G.Alvin Pierce- Cambridge University Press, 2002
2. *Structural Dynamics in Aeronautical Engineering*, Maher N. Bismarck-Nasr, AIAA Education Series, 1999
3. *Adaptive Structures: Engineering Applications*, David Wagg, Ian Bong, Paul Weaver, Michael Friswell (eds) , John Willey & Sons, Ltd, 2007

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(R17DCS53) RESEARCH METHODOLOGY
(OPEN ELECTIVE – II)

UNIT - I

Introduction: Research objective and motivation, Types of research, Research approaches, Significance, Research method vs. methodology, Research process.

UNIT - II

Formulating a research problem: Literature review, Formulation of objectives, Establishing Operational definitions, Identifying variables, constructing hypotheses.

UNIT - III

Research design and Data Collection: Need and Characteristics, Types of research design, Principles of Experimental research design, Method of data collection, Ethical issues in collecting data.

UNIT - IV

Sampling and Analysis of data: Need of Sampling, Sampling distributions, Central limit theorem, Estimation: mean and variance, Selection of sample size Statistics in research, Measures of Central tendency, Dispersion, asymmetry and relationships, Correlation and Regression analysis, Displaying data

UNIT - V

Hypothesis Testing: Procedure, Hypothesis testing for difference in mean, variance limitations, Chi-square test, Analysis of variance (ANOVA), Basic principles and techniques of writing a Research Proposal

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age International Publisher, 2009

2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://www.socialresearchmethods.net/kb/>

2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/.(Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications. StatSoft, Tulsa, OK.

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(R17DME52) INDUSTRIAL MANAGEMENT
(OPEN ELECTIVE-II)

UNIT- I

Concepts of Management and Organisation - Functions of Management - Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs - Systems Approach to Management.

UNIT –II

Designing Organisational Structures : Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

UNIT –III

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Plant Layout - definition, objectives, types of production, types of plant layout - various data analyzing forms-travel chart. Work study - Definition, objectives, method study - definition, objectives, steps involved-various types of associated charts-difference between micromotion and memomotion studies. Work measurement- definition,time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, differences with time study.

UNIT –IV

Materials Management-Objectives, Inventory - functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager,associated forms.Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CPM)-critical path calculation-crashing of simple of networks.

UNIT –V

Inspection and quality control, types of inspections - Statistical Quality Control-techniques-variables and attributes-assignable and non assignable causes- variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan- single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Introduction to Human Resource Management, Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating.- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, marketing vs selling, marketing mix, product life-cycle.

TEXT BOOKS:

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.
3. A.R.Aryasri, Management Science , Tata McGraw-Hill, 2002.

REFERENCE BOOKS:

1. Panner Selvam, Production and Operations Management, PHI, 2004.
2. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering, Galgotia Publications, Pvt., Limited.
3. Phillip Kotler, Marketing Management, Pearson, 2004.

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(R17DEC52) INTERNET OF THINGS
(OPEN ELECTIVE –II)

Unit 1: The IoT Networking Core :
Technologies involved in IoT Development: Internet/Web and Networking Basics OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing IoT Platform overview Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.
Unit 2: Network Fundamentals:
Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.
Unit 3: IoT Architecture:
History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis. The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN Security aspects in IoT
Unit 4: IoT Application Development:
Application Protocols MQTT, REST/HTTP, CoAP, MySQL.
Back-end Application Designing
Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools
Unit 5: Case Study & advanced IoT Applications:
IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)
TEXT BOOKS:
1. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann
REFERENCES:
1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
3. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
4. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.

5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition
7. F. Adelstein and S.K.S. Gupta, "Fundamentals of Mobile and Pervasive Computing," McGraw Hill, 2009.

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(R17DCS52) INFORMATION SECURITY
(OPEN ELECTIVE – II)

UNIT I

A model for Internetwork security, Conventional Encryption Principles & Algorithms (DES, AES, RC4, Blowfish), Block Cipher Modes of Operation, Location of Encryption Devices, Key Distribution.

Public key cryptography principles, public key cryptography algorithms (RSA, Diffie-Hellman, ECC), public Key Distribution.

UNIT II

Approaches of Message Authentication, Secure Hash Functions (SHA-512, MD5) and HMAC, Digital Signatures, Kerberos, X.509 Directory Authentication Service, Email Security: Pretty Good Privacy (PGP)

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT III

Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Firewalls: Firewall Design principles, Trusted Systems, Intrusion Detection Systems

UNIT IV

Auditing For Security: Introduction, Basic Terms Related to Audits, Security audits, The Need for Security Audits in Organization, Organizational Roles and Responsibilities for Security Audit, Auditors Responsibility In Security Audits, Types Of Security Audits.

UNIT V

Auditing For Security: Approaches to Audits, Technology Based Audits Vulnerability Scanning And Penetration Testing, Resistance to Security Audits, Phase in security audit, Security audit Engagement Costs and other aspects, Budgeting for security audits, Selecting external Security Consultants, Key Success factors for security audits.

TEXT BOOKS:

1. Cryptography and Network Security by William Stallings, Fourth Edition, Pearson Education 2007.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2008.
3. Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.
4. Information Systems Security by Nina Godbole, WILEY 2008.

REFERENCE BOOKS:

1. Information Security by Mark Stamp, Wiley – INDIA, 2006.
2. Fundamentals of Computer Security, Springer.
3. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY 2006.
5. Modern Cryptography by Wenbo Mao, Pearson Education 2007.
6. Principles of Information Security, Whitman, Thomson.

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(R17D7683) DIGITAL SIMULATION LAB-II

I SOFTWARE DEVELOPMENT FOR THE FOLLOWING USING FINITE ELEMENT METHODS

Thin walled beams
Plate bending
Beams analysis
Trusses analysis
Thin shells analysis

II AEROSPACE STRUCTURAL ANALYSIS USING ANSYS

Structural analysis of aircraft wing
Structural analysis of aircraft wing (Composite material)
Analysis of fuselage
Analysis of landing gear
Structural and thermal analysis of exposed surface of space shuttle using FGM material
Fractural mechanics of crack propagation of thin panel

III. SIMULATION EXPERIMENTS IN DYNAMICS AND CONTROL USING MATLAB AND SIMULINK

Simulation of Aircraft motion-longitudinal dynamics, lateral dynamics
Six-degrees-of-freedom simulation of aircraft motion with illustration of F-16 model

REFERENCES

1. *Engineering Analysis with ANSYS Software,* Y. Nakasone, S.Yoshimoto, T. A. Stolarski, Elsevier Publication, 2006
2. *Atmospheric and Space Flight Dynamics,* Ashish Tewari, Birkhauser Publication, 2007
   Modern Control Design with MATLAB and Simulink, A. Tewari

COURSE COVERAGE SUMMARY

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QUESTION BANK

M.TECH I YEAR – I SEMESTER

COURSE COVERAGE SUMMARY

FOR

AERODYNAMICS OF FLIGHT VEHICLES

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS / TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Foundations Of aerodynamics: Bases Of AERODYNAMIC Design	4-19	1-5	ARNOLD M. KUETHE AND CHUEN-YEN CHOW	JOHN WILEY & SONS, INC.	Fifth Edition, 1997

Code No: R15D7605

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Aerodynamics of Flight Vehicles

(ASP)

Roll No			N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

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SECTION - I

1. A symmetrical airfoil of 1-m chord is used to produce a lift per unit span of 540 *N/m* when flying through sea level air at a speed of 40 *m/s*. Compute the sectional lift coefficient of the airfoil, from which you may determine the angle of attack (in degrees) that is required to produce such a lift.

(Or)

2. Using thin-air foil theory, derive an expression for lift and moment coefficients for a cambered airfoil.

SECTION – II

3. An untwisted wing with an elliptical planform and an elliptical lift distribution has an aspect ratio of 6 and a span of 12 m. The wing loading (defined as the lift per unit area of the wing) is 900 N/m^2 when flying at a speed of 150 km/hr (41.67 m/s) at sea-level. Compute the induced drag for this wing.

(Or)

4. Explain the following:
   a) Critical Mach number
   b) Drag divergence Mach number
   c) Prandtl-Glauert transformation for a subsonic airfoil.

SECTION – III

5. a) A rectangular wing of aspect ratio 10 is flying at a Mach number of 0.6. What is the approximate value of $dC_l/d\alpha$?
   b) What is the influence of sweepback on wave drag of a supersonic wing?

(Or)

6. The plane Couette flow is a flow between two infinite parallel plates, one of which is sliding relative to the other in a direction parallel to itself. Suppose the plate at y = 0 is stationary and the one at y = h is moving at a velocity U_1 and is maintained at temperature T_1. For an insulated lower plate, show that the temperature distribution is
   $T = T_1 + \frac{\mu U_1^2}{2k}\left(1 - \frac{y^2}{h^2}\right)$

SECTION – IV

7. a) What are the factors affecting instability and transition?
   b) What are the effects of compressibility on skin friction?

(Or)

8. a) What is the effect of riblets on drag of a flat plate?
   b) Explain the stratford criterion for turbulent separation?

SECTION – V

9. Explain the Gust problem and significance of Küssner Function

(Or)

10. The vorticity vector, ω, is defined from the velocity vector, q, as follows $\omega = \nabla \times q$. Show that the vorticity vector satisfies the equation of continuity

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Code No: R15D7605-151

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: Aerodynamics Of Flight Vehicles

(Aero Space Engineering)

Roll No________________________________

Time: 3 hours **Max. Marks: 75**

Note: Question paper Consists of 5 SECTIONS (One SECTION for each UNIT) and answer FIVE Questions, Choosing ONE Question from each SECTION. Each Question carries 15 marks.

* * * * * *

SECTION - I

1. A thin airfoil has a cubic camber line defined by $z = kc\,(x^3 - 3x^2 + 2x)$ in cartesian set of axis system with its origin at the leading edge. Its maximum camber is 2% of the chord. Determine C_l and $C_{m,\,c/4}$ at 3^o incidence.

(Or)

2. Discuss the properties of symmetric and cambered airfoils. Compare the circulation distribution and aerodynamic characteristics of symmetric and cambered airfoils.

SECTION – II

3. Derive the fundamental equation of Prandtl's lifting line theory and obtain an expression for the induced drag coefficient for elliptic lift distribution.

(Or)

4. **(a)** Using linearized subsonic potential equation, derive an expression for the coefficient of pressure over a thin body at a small angle of attack. *(8 marks)*

   (b) A thin flat plate is kept at angle of attack of 4^0 in a uniform subsonic stream of Mach number 0.6. The coefficient of pressure at mid chord in incompressible flow is given as Cp = - 0.07. Determine the pressure coefficient at the same point for Mach number 0.6. *(7marks)*

SECTION – III

5. Derive the governing momentum and energy equations for the compressible laminar flow of a perfect gas in similarity form using Illingworth transformation.

(Or)

6. Write Notes on:
   i) Prandtl - Goethert transformation. *(5 marks)*
   ii) Effect of sweep back angle. *(5 marks)*
   iii) Lift enhancement techniques. *(5 marks)*

SECTION – IV

7. (a) What are the factors influencing boundary layer separation? How is boundary layer separation controlled? *(10 marks)*

   (b) Explain the role of free stream turbulence on laminar-turbulent transition of boundary layers. *(5 marks)*

(Or)

8. (a) Write short notes on *"engineering prediction of turbulence"*. *(7marks)*

   (b) With a neat sketch explain the sequence of events of *"shock wave - boundary layer interactions"*. *(8 marks)*

SECTION – V

9. The equation of a paraboloid of length l and whose axis is in line with x axis is given as $c(x/1) = y^2 + z^2/a^2$, $0 \le x \le l$ *and* $0 \le y, z \le a$. Obtain the downwash expression at the surface. If a slender paraboloid undergoes SHM about its nose in a vertical y–z plane, find the unsteady downwash expression at the surface.

(Or)

10. Explain briefly Lowey's problem: returning Wake problem with neat diagrams.

Code No: R15D7605-151-S

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Aerodynamics of Flight Vehicles

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION – I

1. Derive the fundamental equation of thin aerofoil theory for the symmetric aerofoil?

(Or)

2. (a) State and Explain the Kelvin Circulation Theorem? Briefly discuss the starting vortex?

(b) State and explain the Kutta condition for finite angle and cusp trailing edges?

SECTION – II

3. (a)Derive the fundamental equation of Prandtl's lifting-line theory for finite wing?

(b) Write a short notes on (i) Downwash and induced drag (ii)Trailing vortices (iii) Horse-shoe vortex.

(Or)

4. (a)Derive the compressibility correction for compressible flow over thin aerofoil at small angle of attack using Prandtl-Glauert transformation?

(b) At a given point on the surface of an airfoil, the pressure coefficient is -0.3 at very low-speeds. If the freestream Mach number is 0.6, calculate the C_p at this point?

SECTION – III

5. Derive the linearized velocity potential equation for compressible flow over a thin airfoil using small perturbation theory?

(Or)

6. (a)Consider the NACA 0012 airfoil at zero angle of attack. The minimum value of pressure co-efficient on the surface is – 0.43. Estimate the critical Mach number of this aerofoil?

(b)Drive the energy equation governing compressible laminar boundary layer?

SECTION – IV

7. Write short notes on i) Airfoils with various high lift devices ii) Secondary flows iii) Vortex lift.

(Or)

8. Derive the equations governing the two-dimensional, incompressible and isothermal turbulent shear flows?

Note: Consider the boundary layer equation of motion as given below.

$$\rho\left(\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}\right) = -\frac{\partial p}{\partial x}+\frac{\partial}{\partial y}\left(\mu\frac{\partial u}{\partial y}\right)$$

SECTION – V

9. Discuss briefly about unsteady lifting force coefficient and unsteady aerodynamics of slender wings?

(Or)

10. Explain briefly Lowey’s problem: returning Wake problem with neat diagrams.

Code No: 5176H **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, February - 2014

AERODYNAMICS OF FLIGHT VEHICLES

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Instructions:

i) Part A is compulsory Question for 20 marks.
ii) Part B consists of five questions with "either" "or" pattern. The student has to answer any one. However students have to answer five questions from Part B (numbered from 2 to 6)

PART - A

(Answer all sub questions)

5 × 4 marks = 20

1.a) What is Kutta condition and why it is important in airfoil theory?
b) What are trailing edge vortices and how they are generated around wings?
c) Why it is necessary to have wing sweep for high speed flight vehicles?
d) Why transition from laminar to turbulence flow occurs?
e) What is Reynolds analogy?

PART - B

5 × 8 marks = 40

Answer either "a" or "b" from each question, but not both

2.a) Describe suitable numerical method for the circulation distribution on an arbitrary cambered airfoil.

OR

b) For a symmetrical airfoil, if the γ distribution is given by, $\gamma(\theta) = 2\alpha U_\infty \frac{1+\cos\theta}{\sin\theta}$
Find expression for c_l and c_m using above vortex distribution.

3.a) With the help of neat sketches, describe flow field around finite wing in incompressible flow? What is winglet and why it is used in wing design?

OR

b) Derive expression for C_p for small perturbation supersonic flow.

4.a) Describe area rule for the design of wing-fuselage configuration at supersonic speeds.

OR

b) What are the similarity parameters used for the study of compressible boundary layer? Under what condition the velocity and temperature profile would be similar in the above flow (explain with neat sketch)?

5.a) With the help of neat sketch explain Tollmein-Schlichting instability.

OR

b) Describe flow around spheres and circular cylinder with special emphasis on transition and flow separation.

6.a) Write short note on following:
i) Reynolds stresses ii) Laminar sublayer iii) Turbulent drag reduction

OR

b) Sketch the flow field and pressure distribution over a typical multi-element airfoil.

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COURSE COVERAGE SUMMARY

FOR

ENGINEERING ANALYSIS OF FLIGHT VEHICLES

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS / TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Engineering Analysis Of Flight Vehicles	1,2,3,6,7,8,9, 11	1-5	HOLT ASHLEY	DOVER PUBLICATIONS	1992

Code No: R15D7602

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Engineering Analysis of Flight Vehicles

(ASP)

Roll No			N	3						

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Briefly discuss about the key factors affecting the vehicle configuration.

(Or)

2. Discuss about the strut wire braced biplane of world war I era

SECTION – II

3. Show the relationship between stability axes and prinicipal axes, with the origins at the C.M.?

(Or)

4. What are the equations of motion governing the time histories of angular velocity vector ω and linear velocity vector of the C.M.?

SECTION – III

5. Show the conventional and canard wing-tail arrangements at an angle of attack corresponding to zero airplanes' CL with a sketch.

(Or)

6. a) What is the influence of a free elevator on static stability?

SECTION – IV

7. Derive the equations of boost from a rotating planet in planet-fixed central system

(Or)

8. The sounding rocket is launched under the following conditions:
   Total required $\Delta\upsilon = 28000$ m/s
   Total weight on the pad = 3900 N
   Specific impulse = 15000 /sec, for all stages
   Propellant loading fraction: $\frac{W_{Propellant}}{W_{Gross}} = \frac{15}{17}$, for all stages
   Compare the maximum payload that can be carried by a single stage.

SECTION – V

9. Derive the expression for maximum deceleration of a re-entry body and the altitude at which this occurs.

(Or)

10. Derive the equation for the flight path angle of a lifting re-entry vehicle

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Code No: R15D7602-151 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: ENGINEERING ANALYSIS OF FLIGHT VEHICLES

(Aero Space Engineering)

Time: 3 hours **Max. Marks: 75**

Note: Question paper Consists of 5 SECTIONS (One SECTION for each UNIT) and answer FIVE Questions, Choosing ONE Question from each SECTION. Each Question carries 15 marks.

* * * * * *

SECTION - I

1. Explain in brief about the supersonic Delta-Winged Interceptor (Convair F-102)

(Or)

2. Compare and contrast the external configurations of a subsonic and a supersonic aircraft with the help of neat sketches.

SECTION – II

3. Derive the equations of perturbed longitudinal motion and explain them.

(Or)

4. a) Discuss in detail the choice of vehicle axes.
   b) Consider an aircraft in uniform motion ,with speed v_c at angle of attack α in a medium of constant density ρ, A typical length dimension is l . Find the drag D on the vehicle

SECTION – III

5. Explain in detail about the forces and moments of control surfaces of an aircraft.

(Or)

6. Briefly discuss about the dynamics of control surfaces.

SECTION – IV

7. Study analytically the performance of a jet-powered aircraft flying in the stratosphere under the following approximations:
   Thrust $T = T_s\,(\rho / \rho_s)$, Density $\rho = \rho_s\, e^{-h/H}$, $L = W$, $C_D = C_{D0} + (C_L^2 / \pi eAR)$
   Here h is altitude measured from base of the stratosphere, at which altitude quantities are identified by subscript *s.* Also H,W, C_{D0} and πeAR all are constants, and T at full throttle is independent of speed for a given *h*.
   Find the following as functions of *h*.
   1) Maximum rate of climb for constant velocity in direction of flight path

2) Maximum rate of climb

3) Minimum *t*ime to climb between two altitudes.

(Or)

8. Explain about Equations of boost from a rotating planet.

SECTION – V

9. Briefly discuss about the maximum declaration of a re-entry body and the altitude.

(Or)

10. Derive the equation of motion of launch vehicle under the influence of Earth's rotation.

Code No: **R15D7602-151-S**

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Engineering Analysis of Flight Vehicles

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Briefly discuss about any five factors affecting the vehicle configuration.

(Or)

2. Discuss about the strut wire braced biplane of World War I era.

SECTION – II

3. Derive an equation for vector and scalar relations of Newton's second law.

(Or)

4. Derive the equations of perturbed longitudinal motion and explain them.

SECTION – III

5. Explain in detail about the forces and moments of control surfaces of an aircraft.

(Or)

6 A).Briefly discuss about impact of stability requirements on design and longitudinal control.

B) Briefly discuss about the dynamics of control surfaces.

SECTION – IV

7. Briefly discuss and write necessary ordinary differential equations to represent dynamic Performance of spacecraft with respect to non rotating planets.

(Or)

8. Derive the Runge-kutta formula for X_{n+1} to third order or fourth order in h for general (nx1) column vectors X and $f(X,t)=\dot{X}$.

SECTION – V

9. Explain the behavior of vehicle motion with appropriate constrained from the equation of motion of launch vehicle under the influence of Earth's rotation.

(Or)

10. Briefly discuss about the maximum declaration of a re-entry body and the altitude.

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Code No: 5176B **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, February - 2014

ENGINEERING ANALYSIS OF FLIGHT VEHICLES

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Instructions:

i) Part A is compulsory Question for 20 marks.

ii) Part B consists of five questions with "either" "or" pattern. The student has to answer any one. However students have to answer five questions from Part B (numbered from 2 to 6)

PART - A

(Answer all sub questions)

5 × 4 marks = 20

1.a) Briefly discuss any 4 factors affecting the vehicle configuration.

b) Draw the $C_{l\alpha}$ versus 'α' for various flap angles on a airfoil and use this to explain graphically, why the slope of the lift curve of a horizontal tail is reduced when the elevator is free to rotate.

c) A small wing is fastened on one end of a rod 5 feet long. The rod is rotating about the other end at 16rpm, causing the wing to move downward. The aspect ratio of the wing is 7, a = 0.08, and b = 2.0in. Speed 100 feet per second at standard sea level. Find the wing lift coefficient at the AOA 10'.

d) In a wind tunnel a wing having a mass of m is suspended from a spring having a constant of 'k'. The wing can move vertically but is restrained from rotating. At rest the wing is at a zero angle of attack. Derive an expression for the vertical position of the wing as a function of time if the wing is displaced from its static position and released.

e) Compare the vehicle performance of military and civil aircraft in respect of stability and control.

PART - B

5 × 8 marks = 40

Answer either "a" or "b" from each question, but not both

2.a) Assume that you wish to analyze a tailless aircraft with a delta wing.
i) Discuss the requirements for longitudinal balance.
ii) What airfoil section would you select? Justify.
iii) What would you employ as your longitudinal control device?
iv) What sort of stick forces should you expect? Why?

OR

b) Airlines have found that passengers prefer travelling in small jets to flying in equal capacity turboprops
i) Why do you think this is the case?
ii) The airlines were able to rationalize the substitution of jets for the turboprops on economic grounds only after the development of small fanjet engines. Why?

3.a) An aircraft is initially in a dive and at the bottom of the dive; the pilot affects a steady pullout with a constant pitch rate $q_o\, rad/s$. Obtain the equations of motion for small disturbances during the pullout.

OR

b) i) An aircraft model is tested in a low speed wind tunnel at an angle of attack of 20 deg, sideslip 12 deg and a bank angle of 30 deg. An internal strain gage balance was used to measure the aerodynamic forces acting on the model, which gives components of force in the body axes system. The measurements $F_x = 100N$, $F_Y = -150N$, and $F_z = -410N$. Determine transformation mat T_b^w, lift, drag and side forces acting on model.

ii) At a certain time during a continuous motion of an airplane the following direction cosine matrix is recorded. It is suspected that the elements marked xx are in error and hence are discarded. Determine the missing elements

$$C = \begin{pmatrix} 0.7899 & -0.3943 & 0.0617 \\ xx & 0.9165 & -0.3196 \\ xx & xx & 0.8966 \end{pmatrix}$$

4.a) Examine the longitudinal stability of airplane using Routh's criterion for the longitudinal characteristic equation given by

$$s^4 + 1.6s^3 + 3.35s^2 + 0.305s + 0.08 = 0$$

OR

b) A light airplane has the following longitudinal transfer functions:

$$G_\alpha(s) = \frac{-(0.19s^3 + 12s^2 + s + 1.75)}{s^4 + 3s^3 + 2.6s^2 + 0.13s - 0.6}$$

$$G_\theta(s) = \frac{-(11s^2 + 22s + 1.3)}{s^4 + 5s^3 + 2.3s^2 + 0.16s - 0.3}$$

Determine longitudinal eigenvalues. Is airplane longitudinally stable?

5.a) Derive equation of motion of launch vehicle under the influence of earth's rotation. Explain the behavior of the vehicle motion with appropriate constrained from the equation.

OR

b) A person standing on a very tall tower fired a bullet with heavy gun. If the drag on the bullet is neglected assuming that there is no atmospheric effect. Explain how rotational affect of earth influences the path of bullet.

6.a) Derive an equation of motion of a particle around a small mass of body in the space. Discuss the significance of terms of the equation.

OR

b) An entry vehicle entering the earth's atmosphere has a mass 50kg and has a diameter of 3.53 m and a half cone angle of 45 degrees, V_{re}=8000m/s. Find the value of ballistic coefficient. If elevation angle is -22 deg, find the velocity at an altitude of 50km.

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Code No: R15D7603

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Rocket and Missile Technology

(ASP)

Roll No			N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

******

SECTION - I

1. a) Write the similarities and differences between rockets and missiles.
   b) Classify the types of missiles.

(Or)

2. Explain about the propulsion system, payload and staging of a missile with an example.

SECTION – II

3. a) What are the different feeds in liquid propellant rocket engine? Explain.
   b) Derive Tsiolskovsky's rocket equation in the absence of gravity.

(Or)

4. Define mass ratio MR and the propellant mass fraction. Derive an expression relating mass ratio and propellant mass fraction.

SECTION – III

5. What are the typical forces acting on a missile while passing through atmosphere? Discuss any of the method of describing aerodynamic forces and moments.

(Or)

6. What do you mean by rocket thrust vector control? Explain any two methods of thrust vector control for solid and liquid propulsion systems?

SECTION – IV

7. Describe about a typical space launch vehicle launching procedure

(Or)

8. a) Explain the criteria for selection of materials for rockets and missiles.
   b) Write a short note on data management in the context of rocket testing.

SECTION – V

9. What are micro aerial vehicles? Write the applications of these vehicles.

(Or)

10. Explain the construction and flow process of a scramjet engine with a neat sketch.

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Code No: **R15D7603-151** **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: Rocket and Missile Technology

(Aero Space Engineering)

Roll No________________________________

Time: 3 hours **Max. Marks: 75**

Note: Question paper Consists of 5 SECTIONS (One SECTION for each UNIT) and answer FIVE Questions, Choosing ONE Question from each SECTION. Each Question carries 15 marks.

* * * * * *

SECTION – I

1. a) What is rocket staging? Derive the rocket payload estimation using rocket equation.
   b) With the suitable examples explain different types of rockets and missiles.

(Or)

2. The booster rocket of a satellite launch vehicle operates an altitude of 30 Km. The rocket has a constant chamber pressure of 7 MPa.

(i) If the nozzle is designed for optimum expansion at an altitude of 16 km determine the area ratio of the nozzle. The specific heat ratio of the gases can be assumed constant and equal to 1.20 . The throat area of the nozzle is 0.1 m^2. The variation of ambient pressure with altitude is given in the following:

Altitude (Km)	0	4	8	12	16	20	30
Pressure (N/m^2)	101325	61660	35651	19399	10353	5529	1186

(ii) What would be the thrust coefficient of the nozzle at the altitude of 30 Km? What is the percentage reduction from the value corresponding to optimum expansion at 30 Km?

(iii) Till what altitude would flow separation in the nozzle take place?

SECTION – II

3. (i) Derive the Rocket "Tsiolkowski" equation.
   (ii) An end burning rocket uses a cylindrical double base propellant grain with a diameter of 200 mm and generates a thrust of 350 N over a period of 300 sec. the thrust coefficient is 1.15. The characteristics of the propellants are:
   Density of propellant grain = 1500 Kg/m^3.
   Speed of Sound(a_{70}=4mm/sec) .
   Choice of index (n)= 0.5
   Characteristic velocity (C*) = 1500 m/sec .Calculate
   (a) Length of propellant grain
   (b) Throat diameter of rocket Nozzle.

(Or)

4. With the help neat diagrams explain different types of liquid propellant rocket feed systems.

SECTION – III

5. a) Explain the forces acting on a missile while passing through atmosphere.
   b) Describe the airframe components of rockets and missiles.

(Or)

6. a) Explain the re-entry body design considerations.
   b) Explain the methods of thrust vector control for solid propulsion system.

SECTION – IV

7. a) Explain the requirements for choice of materials for propellant tanks.
   b) Explain the typical materials used for vessels.

(Or)

8. Explain the trajectory monitoring and flight testing of rockets and missiles, with the instrumentations used.

SECTION – V

9. Write the principle of ramjet and scramjet engine with sketches. What are the applications of scramjet and ramjet engine?

(Or)

10. Write notes on:
    a) Micro Aero vehicles
    b) Applications of UAV`s (Unmanned Aerial Vehicles).
    c) Drones.

Code No: R15D7603-151-S

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Rocket and Missile Technology

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. a) Differentiate between rockets & missiles
   b) Explain inertial guidance system.

(Or)

2. What are the main sub-systems of rockets & missiles? Explain a famous launch vehicle and an ICBM.

SECTION – II

3. With a sketch explain a solid motor, Identify the parts. Explain briefly the types of solid propellants.

(Or)

4. With a sketch explain a liquid engine. Identify the parst. Explain the cooling methods for the engine.

SECTION – III

5. a) Classify the missiles
   b) Show the forces acting on a missile. Explain Aerodynamic control and Thrust vector control.

(Or)

6. a) Explain the thermal protection system for a re entry vehicle.
   b) Describe the rocket dispersions.

SECTION – IV

7. a) What are the properties needed for the materials used for the rockets and missiles.
   b) Explain the typical materials used for them.

(Or)

8. Explain the ground testing and flight testing of rockets and missiles, with the instrumentations used.

SECTION – V

9. Explain the functioning of a ramjet and a scramjet, with sketches. What are the problems in the scramjet design?

(Or)

10. Write notes on: a) Cruise Missiles.
    b) UAV`s (Unmanned Aerial Vehicles).
    c) Sounding Rockets.

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COURSE COVERAGE SUMMARY

FOR

FUNDAMENTALS OF AEROSPACE ENGINEERING

(ELECTIVE – I)

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS / TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Introduction to Flight	1-6 & 9	1, 4 & 5	JOHN D. ANDERSON, JR	TATA MCGRAW-HILL PUBLISHING COMPANY	Fifth Edition,2007
Fundamentals of Aerodynamics	4,5&11	2 & 3	JOHN D. ANDERSON, JR	TATA MCGRAW-HILL PUBLISHING COMPANY	Fifth Edition,2007

Code No: R15D7604

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Fundamentals of Aerospace Engineering

(ASP)

Roll No			N	3							

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks* * * * * *

SECTION – I

1. Draw three views of a commercial aircraft and label all the major parts.
   b. Explain the function of major components of a commercial aircraft.

(Or)

2. What is meant by dimensional analysis? What are the advantages and limitations of it?
   b. A geometrically similar model of an air duct is built to 1/25 scale and tested with water, which is 50 times more viscous and 800 times denser than air. When tested under dynamically similar conditions, the pressure drop is 2 kg/cm^2 in the model. Find the corresponding pressure drop in the full scale prototype and express in cm of water.

SECTION – II

3. Present a numerical iterative solution to obtain the finite-wing properties.

(Or)

4. By considering elliptical lift distribution over the wing, prove that the downwash is constant over the span.
   b. Explain how is induced drag calculated for a wing with elliptical planform?

SECTION – III

5. Define circulation & mathematically obtain the expression for total strength of the vortex tubes in integral form over the wing section.

(Or)

6. Explain how one can predict the drag divergence Mach number and give its significance.
   b. Detail the effect of sweepback on the critical Mach number of finite wing with respect to aspect ratio & airfoil thickness with the help of neat sketches & plots.

SECTION – IV

7. Define the stability types and discuss about different degrees of stability around each axis with the help of sketches.

(Or)

8. By using the energy method for accelerated rate of climb prove that the time rate of change of energy height is equal to the specific excess power.

SECTION – V

9. Define overall propulsive efficiency and describe about ramjet engine construction, working & operational limitations in trans-atmospheric operations.
   b. A small ramjet engine is to be designed for a maximum thrust of 4450 N at sea level at a velocity of 289.56 m/s. If the exit velocity and pressure are 609.6 m/s and 1.0 atm, respectively, how large should inlet be designed.

(Or)

10. Discuss about the following
    a. Importance of aircraft structural weight & Integrity
    b. Importance of fatigue
    c. Importance of weight estimation

****

Code No: R15D7604-151 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: Fundamentals Of Aerospace Engineering

(Aero Space Engineering)

Roll No________________________________

Time: 3 hours **Max. Marks: 75**

Answer all the questions

All questions carry equal marks

* * * * * *

SECTION - I

1. A wind tunnel located at a pressure altitude of 500 meters (ρ = 1.1674 kg/m^3, p = 95472 N/m^2), has a circular test section with 3 meter diameter. The air speed is 80 m/sec in the test section, which is vented to the ambient atmosphere. The air speed in the larger diameter section just upstream of the contraction is 16 m/sec. Calculate upstream diameter, dynamic pressure in the test section, upstream pressure and height of mercury column. [15]

(Or)

2. A supersonic wind tunnel has Mach 2 flow at the test section along with standard sea – level states there. What are the bottle pressure, bottle temperature and area ratio of test section required to maintain the above conditions. [15]

SECTION – II

3. Derive the compressible flow equations in a variable area stream tube. A DC-10 is cruising at its assigned mach number of 0.85. The outside air temperature is 232K. At a given point on the upper surface of the wing the pressure measured is 20,100 N/m^2. The temperature at this point is 221K. What are the lift force, pressure, density and true speed of airplane? [15]

(Or)

4. What is air speed indicator, how it measures air speed and explain different air speed used in aircraft. [15]

SECTION – III

5. a) What is boundary layer and explain the turbulence and laminar boundary layer with diagram. [8]
   b) What is drag and discuss various types of drag. [7]

(Or)

6. Discuss how drag coefficient varies with Mach number and how prediction of drag divergence Mach number is carried out. [15]

SECTION – IV

7. Describe about stability and control of an airplane and give the conditions for static longitudinal stability. Also explain about static margin and neutral point. [15]

(Or)

8. Derive the equation for stick free and stick fix longitudinal stability. [15]

SECTION – V

9. Write short notes on; [15]
   a) Circular orbital velocity,
   b) Space vehicle re-entry heating
   c) Escape velocity.

(Or)

10. Note down the need for developing multistage rocket with suitable numerical example. [15]

R15

Code No: **R15D7604-151-S**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Fundamentals of Aerospace Engineering

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

SECTION - I

1. What are various parts of an aeroplane and give the functioning of control surfaces? How are aerodynamic forces developed on an aeroplane? Describe the parameters affecting these aerodynamic forces through dimensional analysis. [15]

(Or)

2. List out the types of wind tunnel and explain any one of them with neat sketch.[15]

SECTION – II

3. a) Derive the expression for speed of sound. [8]
   b) Derive the 3D Momentum Equation in partial differential form. [7]

(Or)

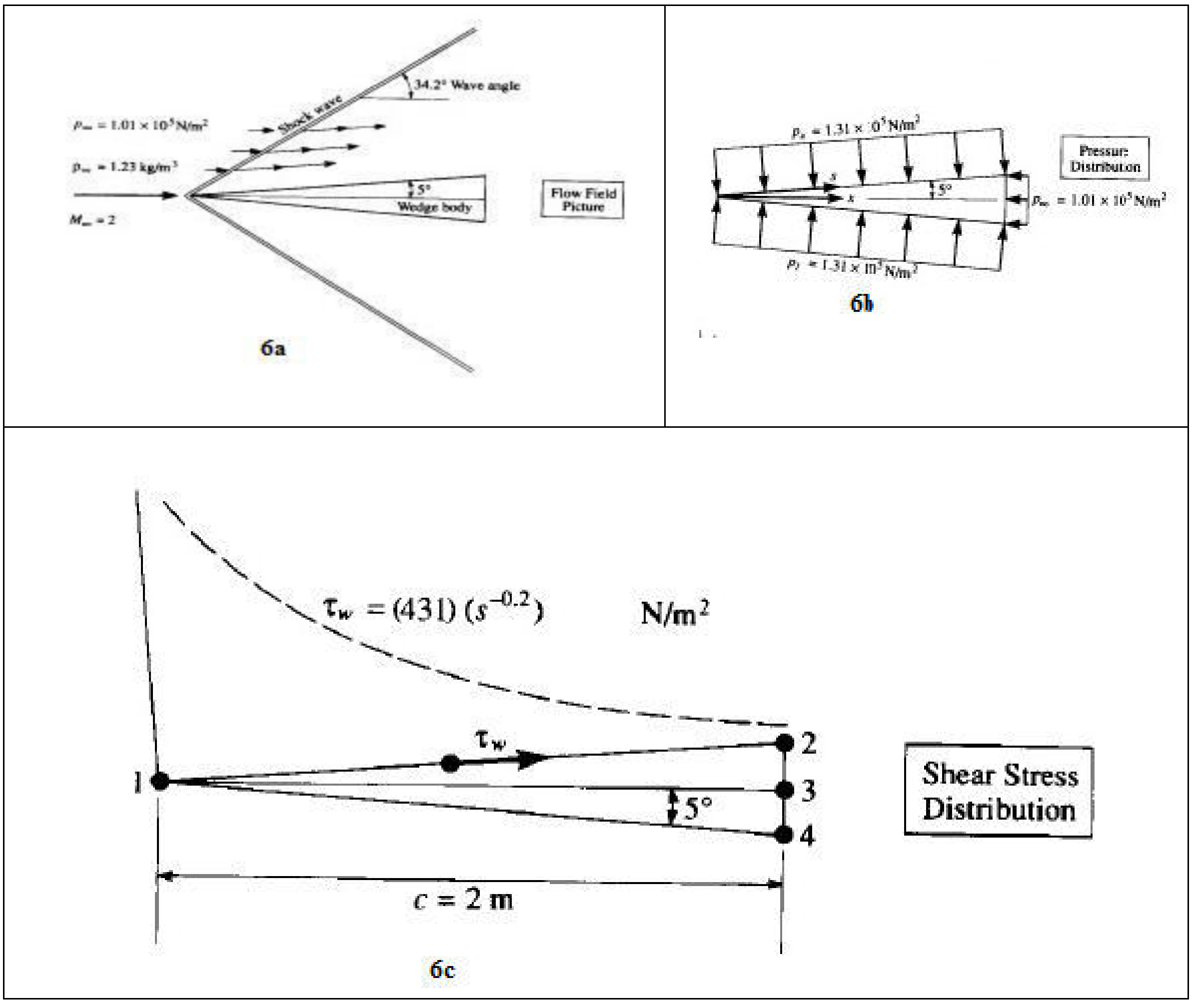
4. Write short notes about: [15]
   a) Downwash and induced drag
   b) Horse shoe vortices
   c) Biot – Savart law
   d) Helmholtz's theorem
   e) Bound vortex

SECTION – III

5. Discuss in detail about: [15]
   a) Leading & trailing edge devices.
   b) Deep stall.
   c) Effect of sweep back on maximum lift.
   d) Airfoil selection & wing design.

(Or)

6. Consider the supersonic flow over a 5^0 of angled wedge at zero angle of attack as sketched in figure 6a. The free steam mach number ahead of wedge is 2.0, and the free stream pressure and density are 1.01 X 10^5 N/m^2 and 1.23 kg/m^3, respectively (this corresponds to standard sea level conditions). The pressure on the upper and lower surfaces of the wedge are constant with distance *s* and equal to each other , namely, $p_u = p_l$ = 1.31 X 10^5 N/m^2,as shown in figure 6b. The pressure exerted on the base of the wedge is equal to p_∞. As seen in figure 6c, the shear stress varies over both the upper and lower surfaces as $\tau_w = 431s^{-0.2}$. The chord length 'c', of the wedge is 2 m. Calculate the drag coefficient for the wedge. [15]



SECTION – IV

7. a) Derive the equation for static longitudinal stability. [8]
   b) Explain spiral divergence and Dutch roll. [7]

(Or)

8. a) Derive an expression for rate of climb. [8]
   b) What is level turn and derive an expression for it. [7]

SECTION – V

9. a) Derive the thrust equation for rocket engine. [8]
   b) Explain about the importance of fatigue in aircraft structures [7]

(Or)

10. Explain in detail about: [15]
    a) Elliptical orbit
    b) Escape velocity
    c) Ballistic entry

Code No: 5176I **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, February - 2014

FUNDAMENTALS OF AEROSPACE ENGINEERING

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Instructions:

i) Part A is compulsory Question for 20 marks.

ii) Part B consists of five questions with "either" "or" pattern. The student has to answer any one. However students have to answer five questions from Part B (numbered from 2 to 6)

PART - A

(Answer all sub questions)

5 × 4 marks = 20

1.a) What is the standard atmosphere? Derive the expression for standard atmosphere in relation with density, pressure and temperature.

b) Derive an expression for speed of sound in air.

c) Explain the effect of sweepback on lift.

d) Derive Breguet's Range Equation for Propeller Engine.

e) Write about the working principle of SCRAM Jet Engine.

PART - B

5 × 8 marks = 40

Answer either "a" or "b" from each question, but not both

2.a) Using the theory of dimensional Analysis, derive an expression for aerodynamic force as a function of Reynolds number and Mach number. State the assumptions.

OR

b) With neat graphs explain:
i) Cl vs α ii) Cd vs α iii) Cl vs Cd
iv) Cl and Cm for cambered and symmetrical airfoil.

3.a) Write short notes on the following:-
i) Critical Mach number ii) Critical pressure coefficient
iii) Drag divergence mach number iv) Swept back wings

OR

b) Discuss in detail about:
i) Boundary layer formation on bluff bodies
ii) Effect of turbulence boundary layer.

4.a) Explain SLUF Condition and obtain the equations of motions for aircraft force system.

OR

b) i) How do you calculate endurance of an airplane?
ii) Explain about various types of propulsion systems used in aircraft and compare the working of piston engine and turbojet engine.

5.a) Explain static longitudinal stability, dynamic longitudinal and lateral stability?

OR

b) Discuss in detail about orbital maneuvers and atmospheric entry. A satellite is to be boosted to an orbital altitude of 500 Km. what is orbital velocity and orbital period?

6.a) Explain atmospheric entry, ballistic entry and lifting entry.

OR

b) Describe importance of structural weight and integrity in the development of aircraft structures.

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COURSE COVERAGE SUMMARY
FOR

AIR- BREATHING PROPULSION AND DESIGN
ELECTIVE – I

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
GAS TURBINES	1	1,2,3,	V.GANESHAN	TATA MC GRAW HILL	2^{ND} Edition
FUNDAMENTALS OF JET PROPULSION WITH APPLICATIONS	11	5	RONALD D.FLACK	CAMBRIDGE AEROSPACE SERIES	17
ELEMENTS OF GAS TURBINE PROPULSION	1,5,9,10	1,2,3,4	JACK MATINGLEY	TATA MC GRAW HILL	2005

Code No: R15D7611

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Air-Breathing Propulsion

(ASP)

Roll No			N	3							

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. (i) Explain (with sketch) the working principle of an ideal turbojet engine; indicate the station numbers in your sketch; draw the T-S diagram referring to the station numbers. Derive an expression for the thermal efficiency of the cycle you have drawn. (7)

   (ii) What is an after burner and why is it used? Draw the T-S diagram of an ideal turbojet engine with afterburner; explain the state points in the T-S diagram. (8)

(Or)

2. A turbofan engine of the mixing type, where the fan is driven by the LPT and the compressor is driven by the HPT, during a ground run of the engine, the following readings were recorded. P_a = 100 kPa, T_a = 300 K, fan pressure ratio = 2, compressor pressure ratio = 8, TIT = 1600K, $\eta_c = \eta_f = \eta_t$, f = 0.065, γ_{air} = 1.4, γ_{gas} = 1.33. Calculate:

   (i) The BPR on the assumption that the outlet streams of the fan and the LPT has the same total pressure just before mixing

   (ii) Specific thrust

   (iii) TSFC

   (15)

SECTION – II

3. (i) What are the different modes of inlet operation? Explain with suitable sketches. (8)

   (ii) With a neat sketch describe the shock swallowing with area variation of an inlet. (7)

(Or)

4. (i) What are the basic factors that influence the design of combustors? Explain. (7)

   (ii) Explain different geometric arrangements of combustors in a gas turbine engine. (8)

SECTION – III

5. (i) How do we decide the number of stator and rotor blades for an axial flow compressor stage? (4)

   (ii) Starting from basics, derive Euler's equation applicable for rotor dynamic compressors. (6)

   (iii)What are the difference between axial and centrifugal compressors (5)

(Or)

6. Describe the working of a ramjet engine. Depict the various thermodynamic processes occurring in it on *T-s* diagram. What is the affect of flight Mach number on its efficiency?

SECTION – IV

7. (i) Explain about SCRAMJET engine with neat sketch. (8)
(ii) What are the challenges of hypersonic vehicles and how to overcome? (7)

(Or)

8. Explain the working principle of *LACE* with a neat sketch and write down its applications.

SECTION – V

9. Explain in detail the engine sizing procedure for a jet powered aircraft.

(Or)

10. Write the sequential matching procedure of a single shaft turbojet engine.

Code No: R15D7611-151

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: Air-Breathing Propulsion

(Aero Space Engineering)

Roll No________________________________

Time: 3 hours **Max. Marks: 75**

Note: Question paper Consists of 5 SECTIONS (One SECTION for each UNIT) and answer FIVE Questions, Choosing ONE Question from each SECTION. Each Question carries 15 marks.

* * * * * *

SECTION - I

1. Explain about the single spool, double spool and multi spool turbofan engine concept with neat diagrams.

(Or)

2. A Brayton cycle operates with a regeneration of 78% effectiveness. The air at the inlet to the compressor is at 0.1 MPa and 34^0C, the pressure ratio is 6.5 and the maximum cycle temperature 950^0C. If the compressor and turbine have efficiencies of 85 percentages each, find the percentage increase in the cycle efficiency due to regeneration.

SECTION – II

3. Explain the methods and advantages in reversing the thrust.

(Or)

4. What is the concept of thrust vector control (TVC)? How it helps in improving the efficiency of engine? Explain different types of thrust vector control.

SECTION – III

5. (i) A centrifugal compressor has a pressure ratio of 4:1 with an isentropic efficiency of 80% when running at 15000 rpm and inducing air at 293 K. Curved vanes at the inlet give the air a pre whirl of 25^0c to the axial direction at all radii. The tip diameter of the eye of the impeller is 250 mm. the absolute velocity at inlet is 150 m/sec and impeller diameter is 600 mm. calculate the slip factor.

   (ii) Explain with neat diagrams the single stage performance characteristics and multistage performance characteristics.

(Or)

6. An ideal ramjet is flying at Mach 3.4 where the ambient temp is 300 K. The fuel has a heating value of 64,000 KJ/Kg and the temp inside the combustion chamber is 2780K. Find the jet exit velocity and fuel ratio. If the air mass flow through the engine is 260 kg / sec, what is the thrust produced and thrust specific fuel consumption? For air γ = 1.4 and C_p = 1.0035 KJ/Kg K which are assumed to remain constant. Take isentropic temperature ratio for M = 3 is 0.566.

SECTION – IV

7. Explain with the neat diagrams the experimental and testing facilities required to estimate the scramjet engine performance.

(Or)

8. Explain the role of scramjet engine in space plane applications. Also explain the current problems in hypersonic scramjet engine.

SECTION – V

9. Explain the major considerations in engine component design. Also discuss with neat diagrams various types of combustion systems.

(Or)

10. Explain with suitable notations and symbols the cycle analysis of one and two spool engines.

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Code No: R15D7611-151-S

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Air- Breathing Propulsion

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. What For an ideal cycle of a reciprocating IC engine, in which heat is added to the working medium air at constant volume the following working conditions are given. P_a=1 bar, T_a = 330 K, Compression ratio 4 , pressure ratio 4, for one Kg of working medium find out (i) Amount of heat added and rejected (ii) Thermal efficiency of Carnot cycle for the given working conditions (iii) thermal efficiency of the cycle (iv) The indicative mean effective pressure.

(Or)

2. Explain with all notations the analysis of piston engine in terms of Power, Friction Horse Power (FHP), Break horse power (BHP), Indicative horse power (IHP), Volumetric efficiency ($\eta_{VO)L}$ Propulsive efficiency ($\eta_{P)}$ and motor efficiency ($\eta_{m)}$.

SECTION – II

3. Explain different types of nozzles used in air breathing and non-air breathing propulsion.

(Or)

4. Derive the non-ideal equations for various nozzles. Also plot the performance parameters to support the comments.

SECTION – III

5. Describe the velocity triangles with neat sketches for axial flow compressor and also bring the performance parameters .

(Or)

6. What is the major difference between ramjet engine and other aircraft engines? Explain the construction, design and performance of ramjet.

SECTION – IV

7. Enumerate the hypersonic scramjet engine methods of analysis.

(Or)

8. Explain with neat diagrams hypersonic intakes and supersonic combustors.

SECTION – V

9. Explain the aircraft mission analysis. Also explain what are factors involved in engine selection.

(Or)

10. How second stage design will help in improving the engine efficiency? Explain in detail.

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COURSE COVERAGE SUMMARY

FOR

MODELING AND SIMULATION OF FLUID FLOWS

(Elective-II)

TEXT BOOK TITLE	Chapters in Text Book	Units / Topics Covered	AUTHOR	PUBLISHERS	EDITION & YEAR
Numerical Computation of Internal and External Flows	1-12	1-5	CHARLES HIRSCH	ELSEVIER PUBLICATION	Second Edition & 2007

R15

Code No: R15D7607

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Semester Regular/supplementary Examinations, February 2017

Modeling and Simulation of Fluid Flows

(ASP)

Roll No			N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Derive the energy equation for 3-D viscous compressible flow in differential non-conservation form.

(Or)

2. a) Write the governing equations of inviscid flow. Explain the physical significance of each term contained.

b) What are the typical boundary conditions for an inviscid flow and viscous flow?

SECTION – II

3. Explain with two examples, about the mathematical behavior of the flows governed by elliptic partial differential equation.

(Or)

4. a) Classify the equation $2u_{xx} - 4u_{xy} + 2u_{yy} + 3u = 0$

b) Classify the following system of equations. Determine the possible range of values for 'a' if the given system of equations are elliptic.

$$\frac{\partial u}{\partial x} + a\frac{\partial v}{\partial y} = 0$$
$$\frac{\partial v}{\partial y} - a\frac{\partial u}{\partial x} = 0$$

SECTION – III

5. a) What do you mean by discretization? What is the underlying philosophy in finite difference discretization?

b) Derive the forward, backward and central difference for the term $\frac{\partial u}{\partial x})_{i,j}$

(Or)

6. What are the four golden rules of finite volume discretization? Show the finite volume discretization for an 1-D unsteady heat conduction equation.

SECTION – IV

7. An explicit scheme for solving the first order wave equation is given by

$$u_j^{n+1} = u_j^n - \frac{c\Delta t}{\Delta x}(u_j^n - u_{j-1}^n)$$

Apply the Fourier stability analysis to this scheme and determine the stability restrictions

(Or)

8. What do you mean by monotonicity of numerical schemes? Explain about the finite volume formulation of schemes and limiters.

SECTION – V

9. Explain the significance of over relaxation method.

(Or)

10. a) What are the typical inflow, outflow and wall boundary conditions for the Pressure- Correction Method ?

b) Explain the difference between staggered grid and co-allocated grid.

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Code No: R15D7607-151

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester, February 2016

Sub: MODELLING AND SIMULATION OF FLUID FLOWS

(Aerospace Engineering)

Roll No________________________________

Time: 3 hours **Max. Marks: 75**

Note: Question paper Consists of 5 SECTIONS (One SECTION for each UNIT) and answer FIVE Questions, Choosing ONE Question from each SECTION. Each Question carries 15 marks.

* * * * * *

SECTION - I

1. State the conservation law for a quantity U. Derive scalar conservation law in the integral conservation form and comment on its properties.

(Or)

2. Discuss the salient features of the following approximations of Navier-Stokes equations
   i. Thin shear layer Approximation
   ii. Parabolized Navier-stokes approximation.

SECTION – II

3. Give the classification of partial differential equations, explaining the characteristics of each type of PDE.

(Or)

4. Discuss about hyperbolic and parabolic equation characteristic surfaces and domain of dependence.

SECTION – III

5. How do you determine the accuracy of the discretization process? What are the uses and difficulties of approximating the derivatives with higher order finite difference schemes? How do you overcome these difficulties?

(Or)

6. Apply the Galerkin method, with linear elements to the first order equation
   $$a\frac{\partial u}{\partial x} = q$$
   Show that on a uniform mesh, $\Delta x_i + \Delta x_{i+1} = \Delta x$, we obtain the same discretization as with central differences.
   b. Differentiate between structured and unstructured grid.

SECTION – IV

7. Using Von Neumann stability analysis, derive the criterion for stability analysis of parabolic PDE. Make necessary assumptions, but state them clearly.

(Or)

8. i. Illustrate the Lax-Wendroff technique for unsteady two dimensional inviscid flow.
   ii. Explain ADI technique for solving 2D, unsteady diffusion problem.

SECTION – V

9. Apply the leapfrog scheme with the upwind space discretization of the convection equation $u_t + au_x = 0$. This is the scheme $u_i^{n+1} - u_i^{n-1} = 2\sigma(u_i^n - u_{i-1}^n)$ calculate the amplification matrix, and show that the scheme is unconditionally unstable.

(Or)

10. Apply a forward space differencing, with a forward time difference (Euler method) to the convective equation $u_t + au_x = 0$. Analyze the stability with von Neumann's method and show that the scheme is unconditionally unstable for a > 0, and conditionally stable a > 0. Derive also the equivalent differential equation and show why this scheme is unstable when a > 0.

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Code No: R15D7607-151-S

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - I Semester supplementary Examinations, Aug 2016

Modeling and Simulation of Fluid Flows

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. i. List the basic equations of motion for a two dimensional, constant property and steady flow filed.
   ii. What are the boundary layer approximations? Using the order of magnitude Approach; explain how the pressure at a location along the flat plate is evaluated for Laminar boundary layer flow over a flat plate.

(Or)

2. i. Describe about boundary layer approximations including separation of boundary layer.
   ii. Write a short note on various flow models.

SECTION – II

3. i. Explain the physical significance of courant freidrichs-lewy (CFL) condition through figures giving geometrical characteristic interpolation for an example of hyperbolic equations.
   ii. Write a short note on
   (a) Simplified models of a convection-Diffusion equation.
   (b) Pure convection equation

(Or)

4. i. Show that the one-dimensional Navier-stokes equation without pressure gradient
   $\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \alpha\frac{\partial^2 u}{\partial x^2}$ is parabolic in x,t.
   ii. Show that the system of Cauchy-Riemann equations
   $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial x} = 0$
   $\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} = 0$ is elliptic nature.

SECTION – III

5. i. What is cell centered formulation? Explain with help of using control volume, semi discretization equation,
   $\Omega_{ij}\partial U / \partial t + \int F.nds = 0.$
   ii. Discuss the properties of discretization schemes and explain upwind discretization applied to FVM.

(Or)

6. i. Solve the simplified sturn-lioville equation:
$\frac{\partial^2 u}{\partial x^2} + y = F$ with boundary conditions y(0) = 0 and $\frac{\partial u}{\partial y}(1) = 0$; using Galerkin finite element method.
ii. Explain the difference between explicit and implicit methods with suitable example.

SECTION – IV

7. i. Explain in detail about an advanced addition to the accuracy barrier.
ii. What is meant by monotonicity of numerical schemes? Explain about it?

(Or)

8. i. Briefly discuss about an analysis of space-discretized systems.
ii. Mention the various iterative methods for the resolution of algebraic systems. Discuss it.

SECTION – V

9. Write short notes on the basic ideas involved in the following overrelaxation methods for the solution of algebraic systems widely used in CFD
   i. Jacobi Overrelaxation
   ii. Successive Overrelaxation
   iii. Symmetric successive Overrelaxation

(Or)

10. Write short notes on
   i. Navier stokes equations for laminar flows
   ii. Numerical solutions for the euler equation
   iii. Density based methods for viscous flows.

* * * * * * * * * *

Code No: 5176J **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I Semester Examinations, February-2014
MODELING AND SIMULATION OF FLUID FLOWS
(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Instructions:
i) Part A is compulsory Question for 20 marks.
ii) Part B consists of five questions with "either" "or" pattern. The student has to answer any one. However students have to answer five questions from Part B (numbered from 2 to 6)

PART - A
(Answer all sub questions)

5 × 4 marks = 20

1.a) Explain the physical Meaning of Substantial Derivative of a fluid element.
b) Discuss the concept of domain of dependence as applicable for hyperbolic partial differential equations.
c) What are the aspects to be considered for grid generation?
d) What is stability and explain its importance in CFD?
e) Write about over-relaxation methods.

PART - B

5 × 8 marks = 40

Answer either "a" or "b" from each question, but not both

2.a) Solve the second-order wave equation
$u_{tt} = c^2 u_{xx}$
on the interval $-\infty < x < +\infty$
with the initial data $u(x,0) = f(x)$
$u_t(x,0) = g(x)$.

OR

b) Classify the following system of equations:
$\frac{\partial u}{\partial t}+8\frac{\partial v}{\partial x} = 0$

$\frac{\partial v}{\partial t}+2\frac{\partial u}{\partial x} = 0$.

3.a) Derive the energy equation in terms of total energy for a viscous flow on the basis of flow model of infinitesimally small fluid element moving with the flow.

OR

b) Derive incompressible Navier-Stokes equation in a spherical coordinate system.

4.a) The DuFort-Frankel method for solving the heat equation requires solution of the difference equation.

$$\frac{u_j^{n+1} - u_j^{n-1}}{2\,\Delta t} = \frac{\alpha}{(\Delta x)^2}\left(u_{j+1}^n - u_j^{n+1} - u_j^{n-1} + u_{j-1}^n\right)$$

Apply the Fourier stability analysis to this method and determine the stability restrictions if any.

OR

b) Consider the non linear equation

$$u\frac{\partial u}{\partial x} = \mu\frac{\partial^2 u}{\partial y^2}$$

where μ is a constant.

i) Is this equation in conservative form? If not, can you suggest a conservative form for the equation?

ii) Develop a finite – difference formulation for this equation using the integral approach.

5.a) Derive the modified equation for the Lax method applied to the wave equation. Retain terms up to and including u_{xxxx}.

OR

b) Derive the stability conditions for the FTCS method applied to the 1-D Linearized Burgers' equation.

6.a) Suggest a way that the PPNS procedure might be extended to 3-D flows.

OR

b) The FVS method of Steger and warming "splits" the system of equations

$U_t + E_x = 0$

In to the following form:

$U_t + E_x^+ + E_x^- = 0$

If this method is applied to the system of equations

$U = \begin{bmatrix} u \\ v \end{bmatrix}$ $E = \begin{bmatrix} cv \\ cu \end{bmatrix}$

Where c is a constant, find the following quantities:

i) [A]

ii) $[\lambda^+]$, $[\lambda^-]$

iii) [T], $[T]^{-1}$

iv) $[A^+]$, $[A^-]$

v) E^+, E^-.

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COURSE COVERAGE SUMMARY
&
QUESTION BANK

M.TECH I YEAR – II SEMESTER

COURSE COVERAGE SUMMARY
FOR
AIRCRAFT CONTROL AND SIMULATION

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Aircraft Control and Simulation	1-7	1-5	BRIAN L. STEVENS AND FRANK L .LEWIS	JOHN WILEY & SONS	2003

Code No: R15D7613

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester supplementary Examinations, February 2017

Aircraft Control and Simulation

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

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SECTION - I

1. Explain any four properties of Quaternions.

(Or)

2. Explain in detail the translational motion of the centre of mass. Define direction cosine matrix and derive it from quaternions.

SECTION – II

3. What is Neutral point? Explain in detail.

(Or)

4. Explain in detail the Euler rotations. Explain the vector rotation by Quaternions?

SECTION – III

5. Explain pitching moment and the control effects on pitching moment

(Or)

6. Derive the longitudinal transfer function for phugoid approximation.

SECTION – IV

7. Write in detail about "Modern Robust Design".

(Or)

8. Discuss the purpose and method of providing pitch-axis stability augmentation.

SECTION – V

9. Write in brief about the Handling – Qualities Requirements on Frequency – Response Specifications and Time – Response Specifications.

(Or)

10. Write in brief: 'The Condition for Convergence of LQ Solution Algorithm'.

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Code No: R15D7613-152

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester Regular Examinations, Aug 2016

Aircraft Control and Simulation

(ASP)

Roll No	1	5	N	3	1	D	7	6	1	0

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Find the Eigen values and Eigen vectors of the given rotation matrix:

$$A = \begin{bmatrix} -\sin\phi & \cos\phi & 1 \\ \cos\phi & \sin\phi & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

(Or)

2. Explain in detail the translational motion of the centre of mass. Define direction cosine matrix and derive it from quaternions.

SECTION – II

3. What is Neutral point? Explain in detail. (Or)
4. Explain in detail the Euler rotations. Explain the vector rotation by Quaternions?

SECTION – III

5. Use the Laplace transform to find the step response of the given transfer function:

$$\frac{s + 2\alpha}{s^2 + s + 1}$$

With alpha as a parameter.

(Or)

6. Describe the aerodynamic forces acting on an aircraft and their variations with Mach number and angle of attack in wind axes.

SECTION – IV

7. Write in detail about "Modern Robust Design".

(Or)

8. Explain
   (a) Tracker Problem,
   (b) Dynamic Inversion.

SECTION – V

9. Explain the advantages and disadvantages of Digital Control.

(Or)

10. Discuss briefly about the Multi variable frequency domain analysis.

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Code No: 5176O **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech II Semester Examinations, August-2014

AIRCRAFT CONTROL AND SIMULATION

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

(Answer all sub questions)

5 × 4 marks = 20

1.a) Prove the distributive property of the rotation matrix with cross product operation.

b) Assuming that neither α-dot nor β-dot dependence is present in the force equations; write down the steps for the calculations that must typically be performed in an explicit state model.

c) Describe an electro-mechanical control system of an aircraft.

d) Discuss in brief, the 'regulator problem' and 'tracker problem' as applied to modern control theory.

e) Explain the terms, sensitivity and cosensitivity along with their role in design of control system of an aircraft.

PART - B

5 × 8 marks = 40

2.a) What do you mean by an inertial frame of reference and state an example of a perfect inertial frame?

b) Explain in detail the different components of acceleration of a body arising from reference of motion of the body in rotating frame to inertial frame of reference.

OR

3.a) Derive the equations of motion (Euler's equation) for the rotational motion of a rigid body.

b) Why state space representation is preferred for non linear systems?

4. Describe the aerodynamic forces acting on an aircraft and their variations with Mach number and angle of attack in wind axes and body axes.

OR

5.a) Describe how Laplace Transform solution for state equation is obtained?

b) Define two aerodynamic angles needed to specify aerodynamic forces and moments.

6.a) Describe the three popular numerical integration algorithms used for analysis of systems.

b) Draw simple lag and simple lead networks and write their transfer functions along with state equations.

OR

7.a) Explain how the transfer function of an aircraft dynamics is developed and based on this, explain the short period and phugoid modes of an aircraft.

b) Describe the terms Autopilot and Flight Management System.

8.a) Explain Linear Quadratic Regulator (LQR).
   b) What are the disadvantages of classical control?

OR

9.a) Discuss the condition for convergence of LQ solution algorithms.
   b) What is gain scheduling?

10. Discuss the method of model reduction by partial fraction.

OR

11.a) Discuss the separation principle in Control Design.
   b) What is the need for discretization of continuous controllers in a digital control system?

---oo0oo---

COURSE COVERAGE SUMMARY
FOR
AEROSPACE SENSORS AND MEASUREMENT SYSTEMS

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Experimental Methods for Engineers	2,3,	1	J.P.HOLMAN	TATA MC GRAW HILL	2004
	7	2			
	10	3			
	11	4			
Low Speed Wind Tunnel Testing	1-5	2,3	JEWEL B BARLOW ,WILLIAM H.RAE JR,ALAN POPE	JOHN WILEY THIRD EDITION	1999
Space Craft Dynamics and Control –A practical engineering approach	1-5	5	MARCEL J.SIDI	CAMBRIDGE UNIVERSITY PRESS	1997

Code No: R15D7614 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester supplementary Examinations, February 2017

Aerospace Sensors and Measurement Systems

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

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SECTION - I

1. Explain statistical analysis of experimental data.

(Or)

2. Give different types of errors that occur during measurement with an instrument. Suggest minimizing these errors.

SECTION – II

3. Explain neatly with a sketch, the working of a Doppler Global Velocimetry.

(Or)

4. Describe the following flow measurement systems
(a)Pressure transducers
(b) Thermocouples
(c) Paricle Velocimetry.

SECTION – III

5. A rectangle rosette is mounted on a steel plate having E=2*105N/mm^2 and μ=0.3. The three starins measured as □1=+500μmm/mm, □2=+400μmm/mm, □3=-100μmm/mm. Calculate the principal strains and stress and maximum shear stress. Locate axis of the principal stress.

(Or)

6. Describe three external balances for measurements in wind tunnel.

SECTION – IV

7. Describe basic concept of seismic instrument and explain the practical considerations for seismic instruments

(Or)

8. Explain the construction, principle of working and salient features of Microgyro sensors.

SECTION – V

9. Write short notes on the following
(a)Infrared Earth Sensors
(b)Magnetometers

(Or)

10. Explain in detail the differences between sun sensors and star sensors.

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Code No: R15D7614-152

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester Regular Examinations, Aug 2016

Aerospace Sensors and Measurements Systems

(ASP)

Roll No	1	5	N	3	1	D	7	6	1	0

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. What are the different types of experimental errors? Explain each in detail.

(Or)

2. A certain steel bar is measured with a device which has a known precision of +5mm to -5mm when a large number of measurements is taken. How many such measurements are necessary to establish the mean length 'a' with a 5 percent of significance such that a=a+/- 0.2mm.

SECTION – II

3. Explain path lines, streak lines, stream lines and time lines in a fluid flow.

(Or)

4. Explain in detail the working of Laser Doppler Velocimetry (LDV) and mention its use in turbulence measurements.

SECTION – III

5. Describe the three-component roof balances.

(Or)

6. Explain the working principle of electrical strain gauge for strain measurement.

SECTION – IV

7. What are the vibrational measuring instruments and explain the working principle of any one instrument.

(Or)

8. A cantilever beam of span 3m of steel of cross sectional area 10mm×20mm is subjected to a free end transverse load of 4KN along the depth. Determine the natural frequency of vibration. If the beam used as a simply supported beam loading at center and also determine frequency and vibration.

SECTION – V

9. Explain the working of horizon crossing sensors and Magnetometers with an example.

(Or)

10. Describe briefly where and how the rate and rate integrating gyros are used. Also explain the working of them.

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Code No: 5176R **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech II Semester Examinations, August-2014

AEROSPACE SENSORS AND MEASUREMENT SYSTEMS

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

5 × 4 marks = 20

1.a) The resistance of a certain size of copper wire is given as $R = R_0[1 + \alpha(T - 20)]$ where $R_0 = 6\Omega \pm 0.3\%$ is the resistance at 20^0C, $\alpha = 0.004^0C^{-1} \pm 1\%$ is the temperature coefficient of resistance, and the temperature of the wire is $T = 30 \pm 1^0$C. Calculate the resistance of the wire and its uncertainty.

b) Explain the principle of operation of a laminar flow meter.

c) Define torque and explain how it is measured.

d) Give a brief account of traveling plane waves and standing waves

e) What is are the parameters obtained from magnetometer readings and explain their significance in determining attitude of spacecraft.

PART - B

5 × 8 marks = 40

2. List out any eight factors to be considered in the initial phase of planning an experiment.

OR

3. Illustrate the general experimental procedure to be followed by engineers as an effective way of product development.

4. Explain the working of a Pitot Probe and the role played by it as a part of the Airdata System on an aircraft.

OR

5. a) Describe the working of principle of Particle Image Velocimetry?
b) Define: i) Path line ii) Streak lines iii) Stream lines and iv) Time lines.

6. What are the necessary characteristics of a strain gauge? With the help of relevant equations describe the operation of electrical resistance strain gauge.

OR

7. Explain in detail the significance of wind tunnel testing of aircraft model.

8. a) Explain the operating principle of rate integrating gyro.
b) A small seismic instrument is to be used for measurement of linear acceleration. It has $\omega_n = 100$ rad/s and a displacement sensing transducer which detects a maximum of ±0.1 in. Calculate the maximum acceleration that may be measured with this instrument and the uncertainty in the measurement, assuming ω_n is known exactly.

OR

9. Explain in detail the working of a closed loop pendulous accelerometer.

10. Explain the working of a single axis analog sun sensor.

OR

11. Describe the working of a horizon crossing sensor with a neat sketch.

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COURSE COVERAGE SUMMARY

FOR

COMPUTATIONAL APPROACHES TO AEROSPACE VEHICLE DESIGN

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/ TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Computational Approaches For Aerospace Design – the pursuit of excellence	1-3	1-5	ANDY J KEANE PRASANTH B NAIR	JOHN WILEY & SONS	2005 ISBN 10:0-470-855440-1

Code No: R15D7615 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester supplementary Examinations, February 2017

Computational Approaches to Aerospace Vehicle Design

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. What are the issues involved in the analysis and design of coupled systems? Explain through schematic diagrams the multidisciplinary optimization process workflow using N-square diagram and black-board based approaches. 15M

(Or)

2. (a) Detail about sequential multidisciplinary optimization process workflow by a conventional block diagram and N-square diagram. 10M
   (b) Explain about the fundamental facts that drive all mesh process. 5M

SECTION – II

3. Present some fundamental concepts from nonlinear optimization methods. 15M

(Or)

4. Discuss about conjugate gradient methods for a multi-variable optimizer. 15M

SECTION – III

5. Compare different types of sensitivity analysis techniques and discuss about case studies involving aerodynamic and aero-structural analysis. 15M

(Or)

6. Present a model that combines scenarios both with functions and goals of numerical optimization. 15M

SECTION – IV

7. Discuss the basic steps involved in stagewise unconstrained optimization of computationally expensive functions using global surrogates; also explain surrogate assisted optimization using global models. 15M

(Or)

8. Discuss about the following modelling approximation concepts. 15M
   (a) Data Parallel Local learning (b) Data Partitioning

SECTION – V

9. Discuss full integrated optimization approach for multidisciplinary design optimization along with its advantages and disadvantages. 15M

(Or)

10. (a) Discuss about the design for six sigma uncertainty modelling technique. 7M
    (b) Discuss about evolutionary algorithms for robust design in the presence of uncertainty. 8M

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Code No: R15D7615-152

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester Regular Examinations, Aug 2016

Computational Approaches to Aerospace Vehicle Design

(ASP)

Roll No	1	5	N	3	1	D	7	6	2	2

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Discuss in detail about the principles of aerospace design automation, evolution and innovation. 15M

(Or)

2. (a) Discuss about the role of optimization in design. 5M
(b) What is the need of a mesh? Can we obtain computational results without mesh justify? 5M
(c) What are the advances in modelling techniques of aerospace design? 5M

SECTION – II

3. Discuss the salient features of penalty function method for constrained optimization used in aerospace vehicle design. 15M

(Or)

4. Discuss in detail about 15M
(a) Population versus single point methods (b) Gradient based methods

SECTION – III

5. Explain multi-objective optimization in the context of aerospace vehicle design with examples. 8M
b. Discuss direct and eigen vector methods of multi-objective weight assignment. 7M

(Or)

6. Give a comparative study of different local search application strategies in hybrid metaheuristics. 15M

SECTION – IV

7. Discuss the relevance of local & Multipoint approximation models in aerospace vehicle design & explain the approach based on intervening variables for building approximation models. 15M

(Or)

8. Discuss the key issues involved with the use of surrogate assisted evolutionary algorithm with the best possible solutions. 15M

SECTION – V

9. How Uncertainty can be classified? Explain uncertainty modelling using probabilistic approach and fuzzy set theory with examples? 15M

(Or)

10. Explain simultaneous analysis and design(SAND) formulation for multidisciplinary design optimization and discuss its advantages and disadvantages as compared with fully integrated optimization approach. 15M

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Code No: 5176Q **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech II Semester Examinations, August-2014

COMPUTATIONAL APPROACHES TO AEROSPACE VEHICLE DESIGN

(Aerospace Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

5 × 4 marks = 20

1.a) Write a short note on Design automation.

b) Explain the role of Chromosome repair in numerical optimization

c) Explain with help of a diagram the principle of response surface method and steps involved in its implementation.

d) Discuss the steps involved in the trust region algorithm for surrogate-assisted optimization in unconstrained problems.

e) Briefly explain the Information-gap theory for robust design approach for Aerospace vehicle design.

PART - B

5 × 8 marks = 40

2. Explain the role of parameterization in design and discuss about how spline based approach and morphing helps in manipulating geometrical shapes in design?

OR

3. List out the number of aspects to be considered in aircraft design. Also explain the four fundamental components on which the decision-making process of aerospace vehicle design is to be built.

4. Discuss the salient features of feasible directions method for constrained optimization used in aerospace vehicle design.

OR

5. Explain non gradient based algorithms aspects of a numerical optimization and their common approaches.

6. Explain how finite difference approach is used in conducting sensitivity analysis bringing out its attractive features and strategies used to handle truncation and condition errors?

OR

7. Explain Multi Objective Optimization Technique. Discuss direct and eigenvector methods of multi-objective weight assignment.

8. What is black-box surrogate modeling approximation concept? Explain the steps involved in it.

OR

9. Explain the approach based on intervening variables for building approximation models for Aerospace vehicle design.

COURSE COVERAGE SUMMARY

FOR

ADVANCED TOPICS IN AIR TRAFFIC MANAGEMENT SYSTEMS

(ELECTIVE-III)

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Air Transportation Systems Engineering	1-10	1-5	DONOHUE,G L ET AL	AIAA	2003 ISBN 1-56347-474-3

R15

Code No: R15D7617

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester supplementary Examinations, February 2017

Advanced Topics in Air Traffic Management Systems

(ASP)

Roll No	1	5	N	3						

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

******

SECTION – I

1. What are the various air traffic services provided to aircraft operators? Explain in detail.

(Or)

2. Mention the applications and advantages of airborne collision avoidance systems.

SECTION – II

3. Discuss the effect of schedule disruptions on the economics of airline operations.

(Or)

4. Explain about the modeling of an airline operations control center.

SECTION – III

5. How do you analyze and model ground operations at airports?

(Or)

6.Describe the different phases through which an aircraft transits during the flight

SECTION – IV

7. What are the functions of airborne separation assurance systems?

(Or)

8. How workload of airways and airport personnel affect airspace operations?

SECTION – V

9. Explain the airport facilities provided for efficient ATM

(Or)

10. Write a brief note on cooperative optimal conflict avoidance in free flight airspace.

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Code No: R15D7617-152

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester Regular Examinations, Aug 2016

Advanced Topics in Air Traffic Management Systems

(ASP)

Roll No	1	5	N	3	1	D	7	6	1	0

Time: 3 hours Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION – I

1. What are the subsystems of Air Traffic Management system? Explain.

(Or)

2. Explain in detail about the "Capacity driven operational concept of ATM".

SECTION – II

3. What is the impact of air traffic management on airspace user economic performance?

(Or)

4. Discuss about the modeling of distributed human decision making in traffic flow management operations.

SECTION – III

5. Explain the collaborative optimization of arrival and departure traffic flow management strategies at airports.

(Or)

6. How do you measure the performance of air traffic services? Explain.

SECTION – IV

7. What are the various methods used for accident risk assessment?

(Or)

8. What is TOPAZ model? Why it is important in safety and free flight?

SECTION – V

9. What are the various methods used for accident risk assessment?

(Or)

10. Explain the functionality of automatic dependent surveillance broadcast system.

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COURSE COVERAGE SUMMARY

FOR

SPACE TRANSPORTATION SYSTEMS

(ELECTIVE-IV)

TEXT BOOK TITLE	CHAPTERS IN TEXT BOOK	UNITS/TOPICS COVERED	AUTHOR	PUBLISHERS	EDITION & YEAR
Space Transportation: A system approach to	1-7	1-5	WALTER HAMMOND	AIAA EDUCATION SERIES	1999

Code No: R15D7620 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester supplementary Examinations, February 2017

Space Transportation Systems

(ASP)

Roll No	1	5	N	3						

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

******

SECTION - I

1. Explain the concepts of systems engineering cycle.

(Or)

2. What were the tools and methodologies were followed to make the mission chandrayaan a great success?

SECTION – II

3. Explain the development of solid rocket motors in space shuttles with proper example.

(Or)

4. List out the primary elements of typical space shuttle system and explain them in brief.

SECTION – III

5. What are the principal elements of Integrated Health Management (IHM) and explain them in brief?

(Or)

6. Briefly, illustrate the configuration of the Delta Clipper - Experimental Advanced (DC - XA).

SECTION – IV

7. List the steps involved in the conceptual design process of a launch vehicle. Discuss the five optimization strategies that can be applied to the design process.

(OR)

8. Write short notes on :
   a. Automated data management system.
   b. Automated test and inspection.
   c. Automated launch vehicle and payload handling.

SECTION – V

9. Explain the working principle of Ram Accelerator with neat schematic diagram.

(Or)

10. What are the types of project management? Explain how the Cluster Management is differing from Matrix Management.

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Code No: R15D7620-152

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech. I Year - II Semester Regular Examinations, Aug 2016

Space Transportation Systems

(ASP)

Roll No	1	5	N	3	1	D	7	6	1	0

Time: 3 hours | Max. Marks: 75

Note: This question paper Consists of 5 Sections. Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

* * * * * *

SECTION - I

1. Briefly, illustrates the activities of the basic systems management process

(Or)

2. What were the tools and methodologies were followed to make the mission Mangalyaan a great success?

SECTION – II

3. Write short notes on:
   a. Hypothesized infrastructure.
   b. Integrated Space plan.
   c. Terrestrial independence.

(Or)

4. Explain how the transportation infrastructure for moon and mars missions differ.

SECTION – III

5. What are facilities required for the launch operations and explain them in brief?

(Or)

6. Write the short notes on:
   a. Shuttle Flight Operations
   b. Orbiter Processing
   c. Transfer and launch

SECTION – IV

7. Briefly explain the basic market research steps.

(OR)

8. Explain the process levels involved in technology investment prioritization process.

SECTION – V

9. Write short notes on:
   a. Risk Management
   b. Total Quality Management
   c. Configuration Management

(Or)

10. Write short notes on:
   a. Magnetic Monopoles Concept
   b. Filed and Quantum Effect Propulsion Concepts
   c. Laser and Beamed Energy Propulsion Concepts

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