ANNA UNIVERSITY, CHENNAI

NON- AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY

M.E. AEROSPACE TECHNOLOGY

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4153	Advanced Mathematical Methods	FC	4	0	0	4	4
2.	AS4101	Space Propulsion Systems	PCC	4	0	0	4	4
3.	AS4102	Aerospace Structural Analysis	PCC	3	1	0	4	4
4.	AS4103	Space Vehicle Aerodynamics	PCC	3	0	0	3	3
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective-I	PEC	3	0	0	3	3
7.		Audit course-I*	AC	2	0	0	2	0
PRACTICAL								
8.	AS4111	Launch Vehicle Aerodynamics Laboratory	PCC	0	0	4	4	2
9.	AS4112	Space Propulsion Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**1**	**8**	**30**	**24**

* Audit Course is optional.

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AS4251	Hypersonic Aerodynamics	PCC	3	0	0	3	3
2.	AS4201	Orbital Mechanics	PCC	3	0	0	3	3
3.	AS4202	Computational Modeling and Data Analysis in Aerospace Engineering	PCC	3	0	0	3	3
4.	AO4251	Analysis of Composite Structures	PCC	3	0	0	3	3
5.		Professional Elective - II	PEC	3	0	0	3	3
6.		Professional Elective - III	PEC	3	0	0	3	3
7.		Audit course-II*	AC	2	0	0	2	0
PRACTICAL								
8.	AS4211	Aerospace Structures Laboratory	PCC	0	0	4	4	2
9.	AS4212	Mini Project with Seminar	EEC	0	0	4	4	2
10.	AO4261	Computation Laboratory	PCC	0	0	4	4	2
			TOTAL	**20**	**0**	**12**	**32**	**24**

* Audit Course is optional.

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective -IV	PEC	3	0	0	3	3
2.		Professional Elective -V	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICAL								
4.	AS4311	Project Work I	EEC	0	0	12	12	6
			TOTAL	**9**	**0**	**12**	**21**	**15**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICAL								
1.	AS4411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 75

PROFESSIONAL ELECTIVE COURSES

SEMESTER I, ELECTIVE – I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AS4001	Elements of Satellite Technology	PEC	3	0	0	3	3
2.	AS4002	Cryogenic Technology	PEC	3	0	0	3	3
3.	AS4003	Introduction to Aeronautics and space Technology	PEC	3	0	0	3	3
4.	AS4004	Fundamentals of Combustion	PEC	3	0	0	3	3
5.	AS4072	Computational Heat Transfer	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE – II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AS4005	Missile Aerodynamics	PEC	3	0	0	3	3
2.	AS4006	Spacecraft Attitude Dynamics and Control	PEC	3	0	0	3	3
3.	AS4007	Chemical Rocket Technology	PEC	3	0	0	3	3
4.	AS4071	Aerospace Materials	PEC	3	0	0	3	3
5.	AS4008	Space Vehicle Design	PEC	3	0	0	3	3
6.	AS4009	Theory of Plates and Shells	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE – III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AS4010	Missile Guidance and Control	PEC	3	0	0	3	3
2.	AO4076	Theory of Boundary Layers	PEC	3	0	0	3	3
3.	AO4252	Finite Element Analysis	PEC	3	0	0	3	3
4.	AO4072	Fatigue and Fracture Mechanics	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE – IV

SL. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AO4078	Vibration Isolation and Control	PEC	3	0	0	3	3
2.	AO4074	Non-Destructive Evaluation	PEC	3	0	0	3	3
3.	AS4011	Plasma Engineering	PEC	3	0	0	3	3
4.	AS4012	Rocket and Missile Systems	PEC	3	0	0	3	3
5.	AS4013	Electric Propulsion Systems	PEC	3	0	0	3	3
6.	AO4077	Theory of Vibrations	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE – V

SL. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AS4014	Manned Space Missions	PEC	3	0	0	3	3
2.	AS4015	High Temperature Gas Dynamics	PEC	3	0	0	3	3
3.	AO4073	High Speed Jet Flows	PEC	3	0	0	3	3
4.	AO4075	Smart Materials and Structural Health Monitoring	PEC	3	0	0	3	3
5.	AS4016	Unmanned Aerial Systems	PEC	3	0	0	3	3
6.	AS4017	Reliability and Quality	PEC	3	0	0	3	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

MA4153 ADVANCED MATHEMATICAL METHODS

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To attain the knowledge of solving Partial Differential Equations using Laplace transform.
- To apply Fourier Transform to solve boundary value problems.
- To achieve maxima and minima of a functional.
- To acquire knowledge on using conformal mapping to fluid flow and heat flow problems.
- To understand the tensor analysis as a tool to solve problems arising in engineering disciplines.

UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12

Laplace transform : Definitions – Properties – Transform error function – Bessel's function - Dirac delta function – Unit step functions – Convolution theorem – Inverse Laplace transform : Complex inversion formula – Solutions to partial differential equations : Heat equation – Wave equation.

UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12

Fourier transform : Definitions – Properties – Transform of elementary functions – Dirac delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations : Heat equation – Wave equation – Laplace and Poisson's equations.

UNIT III CALCULUS OF VARIATIONS 12

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.

UNIT IV CONFORMAL MAPPING AND APPLICATIONS 12

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications : Fluid flow and heat flow problems.

UNIT V TENSOR ANALYSIS 12

Summation convention – Contravariant and covariant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation – Gradient - Divergence and curl.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.
- Maximizing and minimizing the functional that occur in various branches of Engineering Disciplines.
- Construct conformal mappings between various domains and use of conformal mapping in studying problems in physics and engineering particularly to fluid flow and heat flow problems.
- Understand tensor algebra and its applications in applied sciences and engineering and develops ability to solve mathematical problems involving tensors.
- Competently use tensor analysis as a tool in the field of applied sciences and related fields.

REFERENCES :

1. Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007.
3. Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 6th Edition, Jones and Bartlett Publishers, 2012.
4. Kay, D. C., "Tensor Calculus", Schaum's Outline Series, Tata McGraw Hill Edition, 2014.
5. Naveen Kumar, "An Elementary Course on Variational Problems in Calculus ", Narosa Publishing House, 2005.
6. Saff, E.B and Snider, A.D, "Fundamentals of Complex Analysis with Applications in Engineering, Science and Mathematics", 3rd Edition, Pearson Education, New Delhi, 2014.
7. Sankara Rao, K., "Introduction to Partial Differential Equations", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
8. Spiegel, M.R., "Theory and Problems of Complex Variables and its Applications", Schaum's Outline Series, McGraw Hill Book Co., 2009.
9. Ramaniah. G. "Tensor Analysis", S. Viswanathan Pvt. Ltd., 1990.

AS4101	SPACE PROPULSION SYSTEMS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES:

This course will enable students

1. To impart knowledge on the basic concepts of space propulsion.
2. To learn about the physics of ionized gases.
3. To get familiarize with the types of nuclear rockets and the basic concepts of nuclear propulsion systems.
4. To study about the radioisotope propulsion.
5. To realise the importance of advanced space propulsion concepts.

UNIT I INTRODUCTION TO SPACE PROPULSIONSYSTEMS 12

Historical outline, Scramjet Propulsion-Scramjet Inlets; Scramjet Performance, Chemical rocket Propulsion-Tripropellants; Metalized Propellants; Free Radical Propulsion, Electric Propulsion, Micropropulsion-Micropropulsion Requirements, MEMS and MEMS- Hybrid Propulsion Systems.

UNIT II BASIC CONCEPTS OF IONIZED GASES 12

Electromagnetic theory: electric charges and fields, currents, and magnetic fields, and applications to ionized gases. Atomic structure of gases - Ionization processes - Particle collisions in an ionized gas – Electrical conductivity of an ionized gas - Kinetic Theory, Introduction to plasma physics- Electrode phenomena.

UNIT III NUCLEAR ROCKET PROPULSION 12

Nuclear Rocket Engine Design and Performance, Types of Nuclear Rockets, Overall Engine Design, Nuclear Rocket Performance, Component Design, Nuclear Rocket Reactors, General Design Considerations, Reactor Core Materials, Thermal Design, Mechanical Design, Nuclear Design, Shielding, Nuclear Rocket Nozzles, General Design Considerations, Heat-Transfer Analysis, Over-all Problem, Hot-Gas Boundary, Cold-Gas Boundary.

UNIT IV RADIOISOTOPE PROPULSION 12

Alternative Approaches, Direct Recoil Method, Thermal Heating Method, Basic Thruster Configurations, Propulsion System and Upper Stage, Relative Mission Capabilities, Primary Propulsion, Auxiliary Propulsion, Thruster Technology, Design Criteria, Performance, Safety, Heat Source Development, Radioisotope Fuel, Capsule Technology, General Considerations, Thermal Design, Fabrication and Non-Destructive Testing Techniques, Pressure Containment, Heat Source Simulation, Oxidation and Corrosion of Encapsulating Materials, Nozzle Performance.

UNIT V ADVANCED SPACE PROPULSION CONCEPTS 12

Introduction, General Consideration for Propulsion in Space, Power Supply, Propellant Storage and Handling Facilities, Electrostatic and Electromagnetic Thrusters, Advanced Electric Propulsion Systems for Space Vehicles, Sputtering, A Thrust Generation Mechanism, Sputtering Phenomena, Possible Performance of Sputtering Thrusters, Energy Efficiency of the Sputtering Process, Analyses of an Elementary Mission with Different Electric Thrusters, General Consideration, Performance Formula for Electric Thrusters, Optimization with Electric Thrusters

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Have knowledge on the basics and classification of space propulsion.

CO2: Comprehend the physics of ionized gases, their theories and particle collisions.

CO3: Demonstrate the working, types and performance of nuclear rockets with their design considerations.

CO4: Learn the basics of radioisotope propulsion with their performance studies.

CO5: Have knowledge on advanced methods of space propulsion systems with new thrust generation mechanisms.

REFERENCES:

1. Czysz, Paul A., Bruno, Claudio, Chudoba, Bernd "Future Spacecraft Propulsion Systems and Integration", Springer, Praxis Publishing Ltd, 2018.
2. George W. Sutton, "Engineering Magneto hydrodynamics", Dover Publications Inc., New York, 2006.
3. George P. Sutton & Oscar Biblarz, "Rocket Propulsion Elements, John Wiley & Sons Inc., NewYork, 9th Edition, 2016.
4. Martin Tajmar, "Advanced Space Propulsion Systems" Springer Verlag GmbH, 2003.
5. Robert G. Jahn, "Physics of Electric Propulsion", McGraw-Hill Series, New York, 1968.
6. William J. Emrich, "Principles of Nuclear Rocket Propulsion" Elsevier Science, 2016.

AS4102 AEROSPACE STRUCTURAL ANALYSIS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

This course will enable students

1. To learn the important technical aspects on theory of bending.
2. To find the shear flow distribution and to locate the shear centre for open and closed sections.
3. To analyse the stability problems involved in aircraft structural components under various modes of loadings.
4. To impart knowledge on how to analyze aircraft structural components under various forms of loading.
5. To gain knowledge on the spacecraft structures and materials used.

UNIT I BENDING OF BEAMS 9+3

Elementary theory of pure bending – Stresses in beams of symmetrical and unsymmetrical sections - Box beams – Generalized theory of bending – Methods of bending stress determination – Principal axes method – Neutral axis method – 'k' method – Deflection of unsymmetrical beams – Stresses in Composite Beams – Deflection of Sandwich Beams – Design Principles.

UNIT II SHEAR FLOW ANALYSIS 9+3

Concept of shear flow in thin walled open & closed sections – Determination of the shear centre in symmetrical and unsymmetrical cross-sections – Flexural shear flow in multi-flange box beams – Shear flow due to combined bending & torsion in closed sections – Torsion of thin-walled open section members – Stress analysis of aerospace components – Tapered wing spar.

UNIT III DESIGN OF COMPRESSION MEMBERS 9+3

Analysis of solid columns – Governing Equations – Critical Loads & Buckled Modes – Thin-walled Compressions Members – Stability Analysis – Design Criterion – Buckling of sheets under compression – Plate buckling coefficient – Inelastic buckling of plates – Sheet-stiffener panels – Effective width – Failure stress in plates and stiffened panels – Local Buckling – Crippling Load Estimation.

UNIT IV ANALYSIS OF AEROSPACE STRUCTURAL COMPONENTS 9+3

Loads on an aircraft – Aerodynamic loads – Manoeuvre loads – Load factor determination – The flight envelope – Shear force, bending moment and torque distribution along the span of the wing and fuselage – Structural parts of wing and fuselage and their functions – Introduction to aeroelasticity – Sources of launch vehicles loads – Launch vehicle categories – Load and acceleration time-line profile.

UNIT V REQUIREMENTS OF SPACECRAFT STRUCTURES 9+3

Introduction & General Aspects – The Satellite Primary Structure – Load Classification – Typical Requirements – Strength – Failure Theories – Buckling – Sources of Vibration – Frequency Limits – Stiffness, Damping & Mass Distribution – Satellite Vibration Analysis – Response Spectrum – Design Requirements – Materials Used for Construction – Mechanical Interfaces.

L : 45, T : 15, TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Apply the concept of normal stress variation on unsymmetrical sections subjected to bending moments on practical problems.

CO2: Find the shear flow variation in thin walled open sections with skin effective and ineffective in bending.

CO3: Evaluate the shear flow variation in single cell and multi-cell tubes subjected to shear and torque loads.

CO4: Analyse the behaviour of buckling of simply supported plates and also to know the effective width of sheet stringers combination.

CO5: Analyse and design structural members subject to compression.

REFERENCES:

1. Bruce.K.Donaldson, "Analysis of Aircraft Structures: An Introduction", Cambridge University Press, 2nd edition, 2008.
2. Bruhn. EF, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co, 1980.
3. Megson, TMG, "Aircraft Structures for Engineering Students", Elsevier Aerospace Engineering Series, 5th Edition, 2012.
4. Peery, DJ and Azar, JJ, "Aircraft Structures", 2nd Edition, McGraw-Hill, New York, 1993.
5. Rivello, RM, "Theory and Analysis of Flight Structures", McGraw-Hill, N.Y., 1993.
6. Sun. CT, "Mechanics of Aircraft Structures", Wiley publishers, 3rd edition, 2021.

AS4103 **SPACE VEHICLE AERODYNAMICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

This course will enable students to

1. Gain knowledge on the basics of low speed aerodynamics
2. Learn the physics involved in compressible flows.
3. Provide enough knowledge on boundary layers and their interactions.
4. Impart knowledge on the aerodynamic characteristics of missile components.
5. Gain an idea about aerodynamic heating phenomena.

UNIT I BASICS OF INCOMPRESSIBLE FLOW 9

Aerodynamic forces and moments - Centre of pressure - Aerodynamic centre - Continuity equation - Momentum equation - Stream function - Potential function - Elementary flows - Flow over cylinder, sphere and cones – Kutta Joukowski theorem– Kutta Joukowski Transformations and its applications.

UNIT II COMPRESSIBLE FLOWS 9

Compressibility - Speed of sound - Normal shock - Oblique shock - Expansion fan - Shock Expansion Theory - Unsteady shock waves - Fanno flow - Rayleigh flow - Wave drag- Crocco's Theorem - Method of characteristics .

UNIT III BOUNDARY LAYER THEORY 9

Laminar boundary layer - Turbulent boundary layer – Prandtle mixing length theory, Velocity distribution loss - Skin friction drag estimation - Shock wave-boundary layer interactions – Thermal Boundary Layer – Exact and Approximate solutions to thermal Boundary Layer flows.

UNIT IV AERODYNAMIC CHARACTERISTICS OF MISSILES 9

Airframe components of missiles - Forebody shapes - Prediction of component characteristics - Wing planform for missiles Delta wing - Vortex break down - Compressibility effect on delta wing - Wing-body interference effects - Transonic and Supersonic drag reduction methods - Fin drag - Body drag.

UNIT V AERODYNAMIC HEATING 9

Heat transfer process - Basic parameters in aerodynamic heating - Reference temperature method - Aerodynamic heating on conical surfaces - Variable entropy effects - Heat transfer across junctures - Non isothermal wall effects - Swept shock interactions - Application of methodology in practical missile design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will

CO1: Have through knowledge on the concepts of incompressible aerodynamics.
CO2: Be able to analyse practical problems involving Fanno and Rayleigh flow and also flow affecting phenomena.
CO3: Have knowledge on the concepts of laminar and turbulent boundary layer flows and their interaction with shock waves and thermal effects.
CO4: Able to demonstrate and analyse different configurations of missiles and their characteristics.
CO5: Be able to design efficient re-entry vehicles by solving the problem of aerodynamic heating.

REFERENCES:

1. Anderson, JD, “Fundamentals of Aerodynamics”, McGraw-Hill Book Co, 6th edition 2017.
2. Chin SS, “Missile Configuration Design”, Mc GrawHill, 1961.
3. Hermann Schlichting, “Boundary Layer Theory”, Springer, 9th edition, 2017.
4. Michael Mendenhall, “Tactical Missile Aerodynamics: Prediction Methodology, Progress in Astronautics and Aeronautics”, 1992.
5. Nielson, JackN, Stever, Gutford, “Missile Aerodynamics”, McGraw Hill, 1960.
6. Anderson, JD, “Modern Compressible Flows”, McGraw-Hill Book Co, 2010

RM4151 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

UNIT I RESEARCH DESIGN **6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES **6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING **6**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS **6**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS **6**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL : 30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

AS4111 LAUNCH VEHICLE AERODYNAMICS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

This laboratory course will enables students

1. To get exposure with a practical knowledge on various aerodynamic principles related to inviscid incompressible fluids.
2. To have a practical exposure on Aerodynamic measurement techniques.
3. To do testing of sub systems and components of aircraft at low speed.
4. To measure force and moments on missile models.
5. To calibrate subsonic and supersonic wind tunnels.

LIST OF EXPERIMENTS:

1. Calibration of subsonic wind tunnel
2. Pressure distribution on a swept wing model
3. Pressure distribution on nose cone model at subsonic speeds
4. Pressure distribution on a sphere model
5. Force and moment measurements on D model using wind tunnel balance
6. Base drag measurements on missile model
7. Pressure distribution on backward step model
8. Thermal boundary layer measurements over a flat plate
9. Calibration of supersonic wind tunnel
10. Wall pressure measurements over a circular cone in a Supersonic flow
11. Wall pressure measurements on a semi wedge in a supersonic flow
12. Flow visualization of a bow shock in front of a bluff body
13. Flow visualization of shock boundary layer interaction
14. Wall pressure measurements in single expansion ramp nozzle

TOTAL: 60 PERIODS

Any 10 Experiments will be conducted.

COURSE OUTCOMES:

Upon completion of this course, students will be able

CO1: To operate and calibrate subsonic and supersonic wind tunnel
CO2: To comprehend the pressure distribution over the streamlined and bluff bodies.
CO3: To measure force and moments on aircraft models
CO4: To measure boundary layer thickness for various models
CO5: To carry out flow visualization at subsonic speeds.

LABORATORY EQUIPMENTS REQUIREMENTS

1. Subsonic wind tunnel
2. Supersonic wind tunnel
3. Wind tunnel balance
4. Schlieren system
5. Pressure Transducers/ pressure scanner
6. Models for testing cone, wedge, bluff body, swept wind, missile, D model and SERN.

AS4112 SPACE PROPULSION LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

This course will enable students to

1. Visualize the shock pattern in supersonic flows
2. Provides an idea of wall pressure distribution on subsonic and supersonic inlets and nozzles.
3. Perform testing on compressor blades and basic knowledge on cold flow studies.
4. Develop ability to analyze and interpret the experimental data using software.
5. Perform experiments on cavity models.

LIST OF EXPERIMENTS:

1. Flow visualization of a secondary injection in a supersonic flow
2. Flow visualization of shock system in front of a supersonic inlet
3. Wall pressure measurements in a supersonic nozzle
4. Wall pressure measurements in a supersonic diffuser
5. Total pressure measurements in the radial direction of a supersonic circular jet
6. Total pressure measurements along the jet axis of a circular supersonic jet
7. Cold flow studies of a wake region behind flame holders
8. Wall pressure measurements of a noncircular combustor
9. Wall pressure measurements of a subsonic diffuser
10. Cascade testing of compressor blades.
11. Pressure distribution on cavity model with injections.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, student will be able

CO1: To perform wall pressure distribution on subsonic and supersonic nozzles

CO2: To acquire knowledge on fundamental concepts of low speed and high speed jets and experimental techniques pertains to measurements.

CO3: To gain adequate knowledge on pressure distribution on cavity models

CO4: To have exposure on wake survey methods.

CO5: To carry out flow visualization at supersonic speeds.

LABORATORY EQUIPMENTS REQUIREMENTS

1. Supersonic nozzle and supersonic diffuser
2. Total pressure probes
3. Symmetrical Cambered aerofoil
4. Models of flame holders and non circular combustor
5. Traversing mechanism (at least 2-D)
6. Pressure Transducers, pressure scanner
7. Cascade model for compressor blades
8. Multitube manometers

AS4001 ELEMENTS OF SATELLITE TECHNOLOGY L T P C 3 0 0 3

COURSE OBJECTIVES:

This course will make students

1. To learn the satellite mission and configurations,
2. To have an basic idea on power system of satellites
3. To learn the attitude and orbit control systems of satellites.
4. To gain knowledge on basic of propulsion systems, structures, and thermal controls involved in satellites.
5. To learn the basic aspects of telemetry systems.

UNIT I SATELLITE MISSIONAND CONFIGURATION 9

Mission Overview – Requirements for different missions – Space Environment, Spacecraft configuration-Spacecraft Bus–Payload–Requirements and constraints– Initial configuration decisions and Trade-offs–Spacecraft configuration process– Broad design of Spacecraft Bus–Subsystem layout–Types of Satellites–Constellations– Applications.

UNIT II POWER SYSTEM 8

Power sources–Energy storage–Solar panels–Deployable solar panels–Spacecraft Power management –Power distribution–Deep Space Probes.

UNIT III ATTITUDE AND ORBIT CONTROLSYSTEM (AOCS) 9

Coordinate system –AOCS requirements–Environment effects – Attitude stabilization – Attitude sensors –Actuators–Design of control algorithms.

UNIT IV PROPULSION SYSTEMS, STRUCTURES AND THERMAL CONTROL 10

Systems Trade-off–Mono-propellant systems –Thermal consideration–System integration design factors – Pre-flight test requirements–System reliability Configuration design of Spacecraft structure– Structural elements–Material selection–Environmental Loads-Vibrations– Structural fabrication– Orbital environments -Average temperature in Space–Transient temperature evaluation– Thermal control techniques– Temperature calculation for a spacecraft– Thermal design and analysis program structure –Thermal design verification–Active thermal control techniques.

UNIT V TELEMETRY SYSTEMS 9

Base Band Telemetry system – Modulation – TT & CRF system–Telecommand system–Ground Control Systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, Students will

CO1: 1 Be able to describe the main components of a satellite and its importance.
CO2: 2 Compare the merits and demerits of various power systems used.
CO3: 3 Be able to learn the dynamics of the satellite.
CO4: 4 Be able to study the design of propulsion systems, structures needed for satellites.
CO5: 5 Acquire knowledge on satellite orbit control and telemetry systems.

REFERENCES:

1. James R.Wertz,"Spacecraft Attitude Determination and Control", Kluwer Academic Publisher, Re edition 2012.
2. James R Wertz & Wiley J. Larsen, "Space Mission Analysis and Design", (Space Technology Library, Vol. 8, Microcosm Publisher, 1999.
3. Marcel J.Sidi, "Spacecraft Dynamics and Control-A Practical Engineering Approach", Cambridge University press, 2000.
4. Lecture notes on"Satellite Architecture", ISRO Satellite Centre Bangalore–560017.

AS4002 CRYOGENIC TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

This course will enable students

1. To learn various thermodynamic cycles for cryogenic plants.
2. To analyse the problems associated with a cryopropellants.
3. To calculate the efficiencies of cryogenic systems.
4. To gain knowledge on the various cycles of cryogenic plants.
5. To compare the performance of cryogenic engines with non-cryogenic engines.

UNIT I FUNDAMENTALS OF CRYOGENICS 10

Theory behind the production of low temperature - expansion engine - heat exchangers - Cascade process - Joule Thomson and magnetic effects - cryogenic liquids as cryogenic propellants for cryogenic rocket engines - properties of various cryogenic propellants - handling problems associated with cryogenic propellants.

UNIT II CRYOGENIC SYSTEMS EFFICIENCY 8

Types of losses and efficiency of cycles - amount of cooling - the features of liquefaction process - cooling coefficient of performance - Thermodynamic efficiency - The energy balancing method.

UNIT III THERMODYNAMIC CYCLES FOR CRYOGENIC PLANTS 8

Classification of cryogenic cycles - The structure of cycles Throttle expansion cycles - Expander cycles - Mixed throttle expansion and expander cycles - Thermodynamic analysis - Numerical problems.

UNIT IV PROBLEMS ASSOCIATED WITH CRYOPROPELLANTS 10

Storage problems of cryogenic propellants - zero gravity problems associated with cryopropellants - phenomenon of tank collapse - geysering effect - material strength considerations.

UNIT V CRYOGENIC ROCKET ENGINES 9

Peculiar design difficulties associated with the design of feed system, injector and thrust chamber of cryogenic rocket engines - Relative performance of cryogenic engines when compared to non-cryo engines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, Students will be able

CO1: To acquire knowledge on the fundamental requirements that are peculiar to cryogenic rocket engines.

CO2: To determine the thermodynamic efficiency of cryogenic systems.

CO3: To carry out thermodynamic analysis for cryogenic plants.

CO4: To demonstrate the peculiar problems associated with cryopropellants.

CO5: To acquire knowledge oncryogenic propulsion systems

REFERENCES:

1. Barron.RF, “Cryogenic systems”, Oxford University, 1985.
2. Dieter K. Huzel& David H. Huang, “Modern Engineering for Design of Liquid-Propellant Rocket Engines", AIAA Series, 1992.
3. Haseldom.G, “Cryogenic Fundamentals”, Academic press, 2001.
4. Sarner.S.F, “Propellant Chemistry”, Reinhold Publishing Corporation New York, 1966.
5. Sutton, G.P. “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 9th edition, 2016.

AS4003 INTRODUCTION TO AERONAUTICS AND SPACE TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Students acquire knowledge about the present space technology.
- Students can focus on various orbits, re-entry paths, and also understand the future scenario.
- To provide an exposure with attitude requirements and design limitations.

UNIT - I FUNDAMENTALS OF ROCKET PROPULSION 12

Space Mission-Types based on Space Environment, vehicle selection. Rocket propulsion-Types, Rocket equation, chemical rocket propulsion, solid propellant rocket motor, liquid propellant rocket engine, Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two stage Multi-stage Rockets-Trade-off Ratios-Single Stage to Orbit-Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories-Impact point calculation-injection conditions-Flight dispersions.

UNIT - II ATMOSPHERIC REENTRY 8

Introduction-Steep Ballistic Re-entry-Ballistic Orbital Re-entry-Skip Re-entry- "Double-Dip" Re-entry - Aero-braking - Lifting Body Re-entry.

UNIT - III FUNDAMENTALS OF ORBIT MECHANICS, ORBIT MANEUVERS 9

Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital Elements-Ground trace In-Plane Orbit changes-Hohmann Transfer Bi-elliptical Transfer-Plane Changes - Combined Maneuvers - Propulsion for Maneuvers.

UNIT - IV SATELLITE ATTITUDE DYNAMICS 8

Torque free axi-symmetric rigid body-Attitude Control for Spinning Spacecraft - Attitude Control for Non-spinning Spacecraft - The Yo-Yo Mechanism - Gravity - Gradient Satellite-Dual Spin Spacecraft- Attitude Determination.

UNIT – V SPACE MISSION OPERATIONS 8

Supporting Ground Systems Architecture and Team interfaces - Mission phases and Core operations - Team Responsibilities - Mission Diversity - Standard Operations Practices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understanding of rocket propulsion, types equation, their stages as well as trajectories
CO2: Ability to understand about Atmospheric Re-entry
CO3: Analysis of orbit Mechanics and their manoeuvres
CO4: Knowledge of Attitude determination of spacecraft/satellites
CO5: Analysis the space mission operations

REFERENCES:

1. "Spaceflight Dynamics", W.E. Wiesel, McGraw Hill, 3rd edition 2012
2. "Rocket Propulsion and Space flight dynamics", Cornelisse, Schoyer HFR and Wakker KF, Pitman, 1984
3. Vincent L. Pisacane, "Fundamentals of Space Systems", Oxford University Press, 2005.
4. Elements of Space Technology for aerospace Engineers", Meyer Rudolph X, Academic Press, 199

AS4004 FUNDAMENTALS OF COMBUSTION L T P C
3 0 0 3

COURSE OBJECTIVES:

This course will enable students

1. To impart knowledge to students on basic fuel and oxidizer characteristics.
2. To impart the concept of various governing equation and role of chemical kinetic in combustion process.
3. To make the students to understand various kinds flame and factors affecting flame.
4. The concept of diffusion flames.
5. Application of calculation in the field of Aerospace engineering.

UNIT I THERMODYNAMICS OF COMBUSTION 9

Combustion, types of fuels and oxidizers, calorific value measurements, flash point, fire point, smoke point, specific gravity, auto ignition temperature, Proximate analysis, ultimate analysis, Ideal gas law, gas mixture, sensible enthalpy, stoichiometry, equivalence ratio, heat of reaction, heat of combustion, heat of formation, adiabatic flame temperature, determination of equilibrium composition.

UNIT II TRANSPORT PHENOMENA AND CHEMICAL KINETIC OF COMBUSTION 9

Mass Transfer Rate Laws, Species Conservation, Some Applications of Mass Transfer, Global Versus Elementary Reactions, Rates of Reaction for Multistep Mechanisms, Net Production Rates, Compact Notation, Relation Between Rate Coefficients and Equilibrium Constants, Steady-State Approximation, The Mechanism for unimolecular Reactions, Chain and Chain-Branching Reactions, Chemical Time Scales, Partial Equilibrium, Reduced Mechanisms.

UNIT III PREMIXED FLAMES 10

Physical Description, detonation and deflagration, Hugoniot curve, Determination of CJ points, Governing Equations, Boundary Conditions, Structure of CH4–Air Flame, Factors Influencing Flame Velocity and Thickness, Flame Speed Correlations, Quenching, Flammability, and Ignition, Quenching by a Cold Wall Flammability Limits Ignition, Flame Stabilization.

UNIT IV LAMINAR DIFFUSION FLAMES 9

Non-reacting Constant-Density Laminar Jet, Physical Description, Conservation Laws, Boundary Conditions, Solution, Jet Flame Physical Description, Simplified Theoretical Descriptions, Flame Lengths for Circular-Port and Slot Burners, Roper's Correlations ,Flow rate and Geometry Effects, Factors Affecting Stoichiometry, Soot Formation and Destruction Counter flow.

UNIT V DROPLET EVAPORATION AND BURNING 8

Simple Model of Droplet Evaporation, Gas-Phase Analysis, Droplet, Simple Model of Droplet Burning, Burning Rate Constant and Droplet, Lifetimes, Extension to Convective Environments, Additional Factors, One-Dimensional Vaporization-Controlled Combustion.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, students will be

CO1: Exposed to different kinds of fuel and oxidizer characteristics.
CO2: Able to realize basic chemical kinetics and mechanisms behind exothermic reactions.
CO3: Exposed to the significance of premixed flames.
CO4: To acquire knowledge on characteristics of diffusion flames, soot formations etc.
CO5: To familiarize in the field of droplet and evaporation theory.

REFERENCES:

1. Kenneth K.Kuo, "Principles of combustion", John Wiley & sons Inc, 2nd edition, 2012.
2. Mishra, DP, "Fundamentals of Combustion",PHI publishers, 2008.
3. Mukunda,HS, "Understanding combustion", Orient Blackswan, 2nd edition, 2009.
4. Stephen Turns , "An Introduction to Combustion: Concepts and Applications", McGrawHill, 4th edition, 2020.
5. VasudevanRaghavan, "Combustion Technology: essentials of flames and burners", Ane Books Pvt.Ltd, 1st edition, 2016.

AS4072	COMPUTATIONAL HEAT TRANSFER	L T P C
		3 0 0 3

COURSE OBJECTIVES:

This course will enable students

1. To get insights into the basic aspects of various discretization methods.
2. To provide basic ideas on the types of PDE's and its boundary conditions to arrive at its solution.
3. To impart knowledge on solving conductive, transient conductive and convective problems using computational methods.
4. To solve radiative heat transfer problems using computational methods.
5. To provide a platform for students in developing numerical codes for solving heat transfer problems.

UNIT I INTRODUCTION 9

Finite Difference Method-Introduction-Taylor's series expansion-Discretization Methods Forward, backward and central differencing scheme for first order and second order Derivatives – Types of partial differential equations-Types of errors-Solution to algebraic equation-Direct Method and Indirect Method-Types of boundary condition-FDM - FEM - FVM.

UNIT II CONDUCTIVE HEAT TRANSFER 9

General 3D-heat conduction equation in Cartesian, cylindrical and spherical coordinates. Computation (FDM) of One –dimensional steady state heat conduction –with Heat generation-without Heat generation- 2D-heat conduction problem with different boundary conditions-Numerical treatment for extended surfaces- Numerical treatment for 3D- Heat conduction-Numerical treatment to 1D-steady heat conduction using FEM.

UNIT III TRANSIENT HEAT CONDUCTION 9

Introduction to Implicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One– dimensional un-steady heat conduction –with heat Generation-without Heat generation - 2D-transient heat conduction problem with different boundary conditions using Implicit, explicit Schemes-Importance of Courant number- Analysis for I-D,2-D transient heat Conduction problems.

UNIT IV CONVECTIVE HEAT TRANSFER 9

Convection- Numerical treatment (FDM) of steady and unsteady 1-D and 2-d heat convection-diffusion steady-unsteady problems- Computation of thermal and Velocity boundary layer flows. Upwind scheme-Stream function-vorticity approach-Creeping flow.

UNIT V RADIATIVE HEAT TRANSFER 9

Radiation fundamentals-Shape factor calculation-Radiosity method- Absorption Method - Montacalro method-Introduction to Finite Volume Method- Numerical treatment of radiation enclosures using finite Volume method. Developing a numerical code for 1D, 2D heat transfer problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, Students will

CO1: Have an Idea about discretization methodologies for solving heat transfer problems.
CO2: Be able to solve 2-D conduction and convection problems.
CO3: Have an ability to develop solutions for transient heat conduction in simple geometries.
CO4: Be capable of arriving at numerical solutions for conduction and radiation heat transfer problems.
CO5: Have knowledge on developing numerical codes for practical engineering heat transfer problems.

REFERENCES:

1. Chung,TJ, “Computational Fluid Dynamics”, Cambridge University Press, 2002.
2. Holman,JP, “Heat Transfer”, McGraw-Hill Book Co, Inc., McGraw-Hill College; 10th edition, 2017.
3. John D. Anderson, “Computational Fluid Dynamics”, McGraw Hill Education, 2017.
4. John H. Lienhard, “A Heat Transfer”, Text Book, Dover Publications, 5th edition, 2020.
5. Richard H. Pletcher, John C. Tannehill & Dale Anderson**, “**Computational Fluid Mechanics and Heat Transfer”, 4th edition, CRC Press**,** 2021
6. Sachdeva,SC, “Fundamentals of Engineering Heat & Mass Transfer”, New age publisher, 4th edition Internationals, 2017.

AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

OUTCOMES

CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX4092 **DISASTER MANAGEMENT** **L T P C**
2 0 0 0

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION **6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS **6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA **6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT **6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT **6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

AX4093 **CONSTITUTION OF INDIA** **L T P C**
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

- The Constitution of India,1950(Bare Act),Government Publication.
- Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094	நற்றமிழ் இலக்கியம்	L T P C 2 0 0 0

UNIT I **சங்க இலக்கியம்** **6**

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
– எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
- போரை நிறுத்திய ஔவையார்

UNIT II **அறநெறித் தமிழ்** **6**

1. அறநெறி வகுத்த திருவள்ளுவர்
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
– ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III **இரட்டைக் காப்பியங்கள்** **6**

1. கண்ணகியின் புரட்சி
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV **அருள்நெறித் தமிழ்** **6**

1. சிறுபாணாற்றுப்படை
- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
- அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
- இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
- சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
நற்றிணை (11) - நண்டு
கலித்தொகை (11) - யானை, புறா
ஐந்தினை 50 (27) - மான்
ஆகியவை பற்றிய செய்திகள்

UNIT V **நவீன தமிழ் இலக்கியம்** **6**

1. உரைநடைத் தமிழ்,
   - தமிழின் முதல் புதினம்,
   - தமிழின் முதல் சிறுகதை,
   - கட்டுரை இலக்கியம்,
   - பயண இலக்கியம்,
   - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

<u>தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்</u>

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
-https://ta.wikipedia.org
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
- தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்