Subject Number: ANTE 324
Subject: Aerodynamics
Units: 6
Weekly Hours: Theoretical: 2
Experimental: 2
Tutorial :

Week	Contents
1 2 3 4	**Navier-Stokes equations** - Introduction - Derivation - Laminar flow between parallel plates - Couette flow - Hydrodynamic lubrication - Sliding bearing - Laminar flow between coaxial rotating cylinders
5 6 7 8 9 10	**Boundary layer theory** - Introduction - Displacement, Momentum, and Energy thicknesses - Momentum equation for the boundary layer - Laminar boundary layer - Turbulent boundary layer - Transition from laminar to turbulent flow - Effect of pressure gradient - Separation and pressure drag
11	**Potential flow theory (Ideal fluid)** - Introduction - Continuity equation - Vorticity equation
12	**Basic concepts in potential flow** - Stream function - Potential function - Circulation
13	**Basic flow patterns** - Uniform flow - Source , Sink - Doublet - Free vortex
14 15	**Combination of basic flows** - Flow past a half body - Flow past a Rankine oval - Flow past a cylinder - Flow past a cylinder with circulation

16 **17**	**Incompressible flow over airfoils** - Introduction - The Kutta condition - Kelvin's circulation theorem - Thin airfoil theory
18	**Airfoil characteristics** - Wind tunnel tests - Estimation of aerodynamic coefficients from pressure distribution - Compressibility effects - Reynolds number effects
19	**Airfoil maximum lift characteristics** - Geometric factors effects - Effect of Reynolds number - Effect of leading and trailing edges devices
20 **21**	**Incompressible flow over wings** - Introduction - Circulation, downwash, lift and induced drag - Finite wing theory
22	**Wing stall** - Stall characteristics - Effect of planform and twist - Stall control devices
23	**Lift control devices** - High lift devices - Spoilers
24	**Flow control devices** - Boundary layer control - Reduction of drag
25 **26** **27** **28**	**Propellers** - Momentum theory - Simple blade element theory - Combined blade element theory and momentum theory - Propeller performance
29 **30**	**Computational methods** - Introduction to panel methods for airfoils - Introduction to panel methods for wings

Subject Number: ANTE 332
Subject: Aircraft Electricity and Instruments
Units:6
Weekly Hours: Theoretical: 2
Experimental: 2
Tutorial :

Week	Contents
1	**Electrical power sources in aircraft** - General introduction - Main sources and drives - Auxiliary sources - Emergency sources
2	**DC generators** - Basic theory - Construction
3	**AC generators** - Basic theory - Construction
4	**DC,AC motors** - Basic theory - Construction
5	**Generators and motors characteristics** - Torque, speed, and load characteristics - Losses and efficiencies
6	**Power generation control** - Stabilizers - Voltage regulators - Differential relays
7	**Generators and motors maintenance** - Inspection - Maintenance
8	**Power conversion and energy storage** - Inverters/ Converters - Transformer Rectifier Units (TRU) - Auto-Transformers - Battery chargers - Batteries
9	**Emergency power generation** - Ram air turbine - Backup power converters - Permanent Magnet Generators (PMG)

10	**Power distribution and electrical loads** - Primary power distribution - Secondary power distribution - Electrical loads - Typical aircraft DC system
11	**Aircraft instruments** - Introduction - Sensors and Transducers - Basic flight instruments
12	**Pitot-static instruments and systems** - Pitot-static probes - Pitot-static system
13	**Altimeter** - Principle of operation - Construction - Types of altimeter
14	**Air speed and vertical speed indicators** - Types of air speed - principle of operation - construction - Types
15	**Attitude indication** - The gyroscope - Artificial horizon - Types of artificial horizon
16	**Turn and Bank indicators (Turn coordinator)** - Principle of operation - Construction - Types
17	**Heading indicating instruments** - Magnetic compass - Remote-indicating compass - Horizontal Situation Indicator (HSI)
18	**Engine parameters measurements** - Engine speed - Temperatures - Pressures - Fuel quantity and fuel flow
19 **20** **21**	**Introduction to avionics** - Basic definitions - Data conversion - Data buses - Computer system - Fibre optics - Software

	Avionic systems
22	- Aircraft Communication Addressing and Reporting System (ACARS)
23	- Electronic Flight Instrument Systems (EFIS) - Displays
24	- Electronic Flight Instrument Systems (EFIS) - Operation - Electronic Centralized Aircraft Monitor (ECAM)
25	- Engine Indicating and Crew Alerting System (EICAS)
26	- Fly-By-Wire (FBW) - Flight Management System (FMS)
27	- Global Positioning System (GPS) - Space, User, Control segments - GPS frequencies
28	- Inertial Reference System (IRS) - Inertial Navigation System (INS) - Gimballed systems - Strap down systems
29	- Traffic Alert Collision Avoidance System (TCAS)
30	- Automatic Test Equipment (ATE) - Built-In Test Equipment (BITE)

Subject Number: ANTE 316
Subject: Mechanical Engineering Design I
Units: 6
Weekly Hours: Theoretical: 2
Experimental: 3
Tutorial :

Week	Contents
1 2	**Simple stresses and material selection** - Tensile stress, shear stress, bearing stress - Choosing suitable materials
3	**Welding** - Design of welding
4	**Combined stresses** - Theories of failures
5	**Application of simple stresses** - Application of simple stresses on rivets
6 7	**Shafts** - Shaft subjected to bending - Shaft subjected to torsion - Shaft subjected to bending and torsion - Shaft subjected to bending and torsion with axial load
8	**Forces on gears** - Forces on spur gear - Forces on helical gear - Forces on bevel gear
9	**Couplings** - Type of couplings - Design of flange coupling
10	**Keys** - Types of keys - Design of keys
11 12 13	**Bearings** - Types of bearings (Rolling and Sliding) - Types of Rolling bearings - Design of Rolling bearings
14 15	**Clutches** - Types of clutches - Design of flat clutch - Design of cone clutch
16 17	**Springs** - Types of springs - Design of springs

18	**Brakes** - Types of brakes - Design of brakes
19 **20** **21**	**Dynamic loading design** - Types of dynamic loading - Endurance limit (σ_A - σ_M) diagram - Goodman line - Soderberg line - Stress concentration factor
22	**Bolts** - Preload of bolts
23 **24**	**Power screw** - Types of power screw - Design of power screw
25	**Pressure vessel** - Design of pressure vessel
26 **27**	**Belts** - Types of belts - Design of belts
28 **29** **30**	**Gears** - Design of spur gears - Design of helical gears - Design of helical gears

Subject Number: CREQ 347
Subject: Engineering and Numerical Analysis
Units: 4
Weekly Hours: Theoretical: 2
Experimental:
Tutorial : 1

Week	Contents
1	**Laplace Transformations (L.T)** - Introduction - Definition of L.T
2	**Inverse Laplace Transformations (I.L.T.)** - Introduction - Definition of I.L.T
3	**Solution of differential equations using L.T** - Method of solution - Examples
4	**Applications** - Using L.T. for solving practical problems
5	**Solution of 2nd order D.E. using power series method** - Introduction - Solution near the ordinary point and singular point
6	**Bessel's equation + Legendre's equation** - Introduction - Application of solution
7	**Solution of partial D.E** - Definition - Methods of solution of P.D.E.
8	**Using of separation method** - Definition of separation method - Examples
9	**Applications of heat transfer** - Solution of unsteady one dimensional heat equation
10	**Matrices** - Introduction and definitions - Special matrices
11	-Properties of matrices, Adj A, A^{-1} - Rank of a matrix - Vectors
12	- Linear transformation - Orthogonal transformation - Eigen values - Eigen vectors

13	**Solution of non- linear equations** - Introduction - Application of non- linear equations
14	**Simple iteration method +** **Bisection method** - Introduction - Description of methods - Examples
15	**Newton –Raphson method** - Derivation - Applications Square Roots Roots of an arbitrary order Reciprocal of any number
16	**Solution of simultaneously linear equations** - Definition of equations - Methods of solution
17	**Direct methods** - Matrix inversion - Gauss- Elimination - Gauss -Jordan Elimination
18	**Indirect methods** - Jacob's method - Gauss- Seidle method
19	**Applications** - Examples - problems
20	**Curve fitting** - linear Regression - Applications of linear regression - Transformation of nonlinear regression to linear regression
21	**Numerical interpolation** - Introduction - Linear interpolation - Quadratic interpolation
22	**Finite differences method + Forward and Backward and center expressions** - Introduction to finite differences method - Derivation of formulas with equal step size
23	**Newton and Lagrange forms** - Using this method for equal segment and unequal segments
24	**Numerical differentiation** - First derivative - Second derivative

25	**Numerical Integration** - trapezoidal rule - Simpson Rule (1/3) - Simpson Rule(3/8)
26	**Two dimensions integration** - Applications - Examples
27 **28**	**Solution of ordinary differential equations O.D.E.** - Taylor series method - Simple Euler method - Modified Euler method - Runge-kutta method
29 **30**	**Finite differences method for solution of differential equations** - Ordinary differential equations - Partial differential equations Elliptic equation Parabolic equation Hyperbolic equation

Subject Number: ANTE 325
Subject: Heat Transfer
Units: 6
Weekly Hours: Theoretical: 2
Experimental: 2
Tutorial :

Week	Contents
1	**Introduction** - General concepts and definitions - Heat conduction - Convective heat transfer - Thermal radiation
2	**Conduction heat transfer (general equation)** - General heat conduction equation - One-dimensional, steady state, conduction through plane wall
3	**Conduction heat transfer (1-D, steady state)** - Composed wall - Cylinder, composed cylinder - Sphere, composed sphere
4 5	**Conduction heat transfer (1-D, steady state, with heat generation) in** - Plane wall - Composed wall - Solid cylinder - Hollow cylinder - Sphere - Critical thickness of insulation
6 7	**Heat transfer through extended surfaces (fins)** - General equation for temperature distribution. - Very long fin - Short fin - End insulated fin - Effectiveness of the fin - Applications for previous subjects
8 9 10	**2-D, Steady state heat conduction** - Analytical solution with different boundary conditions - Exact Solution with different boundary conditions - Numerical solution for two-D steady state heat conduction equation (nodes)

11 12	**2-D Unsteady state heat conduction** - Analytical solution for the unsteady state heat conduction equation. (lumped system) - Numerical solution
13	**Convective heat transfer** - Fluid flow background - Laminar and turbulent flow - Boundary layer growth for external flow and internal flow
14 15	**Forced convection** - Energy equation - Thermal boundary layer and temperature distribution and heat transfer for: Laminar flow over flat plate Laminar flow through closed conduit - Empirical equation for cross flow for cylinder, sphere and tube bank - Empirical equation for turbulent flow
16	**Calculation of dimensionless numbers** - Analytical solution
17	**Natural convection** - General concepts - Grashof number - Free convection for: Vertical plate and tube Horizontal plate and tube
18 19 20 21	**Thermal radiation** - Introduction to thermal radiation - The electromagnetic waves - The black body - The shape factor - Thermal radiation between: Two parallel plates (gray) Two concentric cylinder - Thermal radiation between more than two bodies. - Thermal resistance network - Radiation shields
22 23 24	**Heat exchanger** - General concepts - Types of heat exchangers - Heat exchangers performance by LMTD method - Heat exchanger's effectiveness. - NTU method

25 **26** **27**	**Condensation and vaporization heat transfer on (vertical tube, horizontal tube, tube bank)** - Concepts of condensation - Heat transfer due to condensation - Empirical equation for condensation
28	**Boiling heat transfer** - H.T. due to boiling curve - Empirical equations for boiling
29	**Boiling heat transfer calculation (empirical equations)** - Calculation of heat transfer coefficient
30	**Mass transfer** - General concepts - Mass transfer modes

Subject Number: CREQ 348
Subject: Industrial Engineering
Units: 4
Weekly Hours: Theoretical: 2
Experimental:
Tutorial :

Week	Contents
1	**Preview** - Construction the frequency distribution - Representation the data in Histogram , Frequency polygon and ogive - Measures of location and measures of variation
2	**Probability density function** - Probabilities of simple or two events - Probabilities for combinations of three or more events - Permutations and combinations - The probability density function(p.d.f.)
3 4	**The distribution functions** - The binomial and poisson distributions - The gamma , chi-square and normal distributions
5 6	**Tests of statistical hypotheses** - The nature of a statistical hypothesis, two types of errors and tests about the mean of a normal distribution - Tests about the mean of a normal population when σ^2 unknown - Tests about the mean of abnormal population - Tests about the difference of two proportions ; and tests about the difference of two means
7 8 9	**Correlation and regression** - The sample correlation coefficients ; computation of simple correlation - Testing hypotheses about the population correlation coefficient - Linear regression and testing hypotheses about the parameters in a simple linear regression - Multiple linear regression
10 11	**Analysis of variance (ANOVA)** - One- way analysis of variance with different sample sizes - Two- way analysis of variance

12 13	**Linear programming (L.P.)** - Definition of the L.P. - Forms of L.P. (general , canonical and standard) - Formulation of the mathematical model of the L.P. - Solving the mathematical model using a graphical and simplex methods - Solving the mathematical model using M-technique and two- phase method
15 16	**Transportation and Assignment models** - Finding the starting solution using northwest corner method, Least cost method , Vogell's approximation method (VAM) and Russel's approximation method (RAM) - Finding the optimal solution using stepping stone and multipliers methods - Solving the assignment models in maximized or minimized
17 18	**Network planning** - Graph the network and find the critical path (CP) ; and the program evaluation and review technique (PERT) - Crashing the normal duration to execute the project with least costs
19 20	**Sequencing models** - Processing n jobs through one machine (shortest and largest processing time Spt and Lpt); processing n jobs through two machines - Processing n jobs through m machines ; processing n jobs through two machines with randomly technical routes
21	**Replacement and maintenance models** - Using the average total cost as a criterion to determine the period of replacement the machines - Cost of individual replacement for items of machines - Average cost group replacement per period as a criterion to determine the optimal replacement (individual or grouped) - Maintenance model

22 23	**Inventory models** - General inventory model - Static economic order quality (EOQ) models ; EOQ with price break ; and multi - item EOQ with storage limitation - Probabilistic EOQ model - Single - period models ; and multi period model
24	**ISO** - Total quality management (TQM) ; and ISO:9000
25 26 27	**Quality control** - Acceptance sampling - Calculation the OC-curve for single sampling schemes ; rectifying schemes; double sampling schemes ; and sequential sampling - Process control and control charts ($\bar{X}$ -chart , R-charts ,σ-charts and P-charts) - Quality level - Sampling plans (single , double and multiple)
28 29 30	**Reliability** - Reliability - Failure functions - Mean time to failure MTTF - Variance - Hazard rate function - Conditional reliability - Exponential and Weibull reliability functions - Reliability of system with serial and parallel configuration - Combined series – parallel system and high –level and low – level redundancy

Subject Number: ANTE 317
Subject: Theory of Machines
Units: 6
Weekly Hours: Theoretical: 2
Experimental: 2
Tutorial :

Week	Contents
1	**Mechanisms** - Machine - Theory of machines - Structure - Links - Kinematics pair - Kinematics chain
2 3	**Velocity of Mechanisms** - Velocity diagram. - Relative velocity of two bodies moving in straight line - Relative velocity of point on link - Relative velocity of Four Bar mechanism with binary links - Relative velocity of Four-Bar with binary and ternary links. - Relative velocity of slider crank mechanism. - Rubbing velocity of a pin joint
4 5 6	**Acceleration in mechanisms** - Acceleration diagrams - Tangential component - Radial component - Coriolis component
7 8	**Spur Gear** - Pitch circle diameter - Condition for transmission of constant velocity ratio - Velocity of sliding - Path of contact - Arc of contact - Interference - Rack and pinion
9 10 11 12	**Gear Trains** - Simple gear trains - Compound gear trains - Simple epicyclic gear trains - Compound epicyclic gear trains - Torques on gear trains

13 14	**Friction Belts** - Belt drive - Types of belts - Velocity ratio of belt - Power transmitted - Ratio of driving tension for flat belt - Ratio of driving tension for V- belt - Angle of contact - The effect of centrifugal tension - The effect of initial tension
15 16 17	**Balancing of rotating masses** - Single mass rotating in same plane - Several masses rotating in same plane - Mathematical solution - Graphical solution - Masses rotating in different planes
18 19	**Balancing of reciprocating masses** - Reciprocating masses - (balancing in piston)
20 21	**Speed governors** - Dead weight governors (Portor and Proell) - Spring loaded governors (Hartnell)
22 23	**Gyroscope** - The gyroscope effect on: - airplane - ship - automobile - two wheel vehicle
24 25	**Flywheel** - Turning moment diagram - Energy stored in flywheel - Dimensions of flywheel rim
26 27 28	**Cams and Followers** - Straight flank - Curved flank - Circular - Different followers - Force of spring - Torque reaction
29 30	**Inertia Forces** - Instantaneous center method - Force in crank and connecting rod

Subject Number: ANTE 333
Subject: Aircraft Engines
Units: 6
Weekly Hours: Theoretical: 2
Experimental: 2
Tutorial :

Week	Contents
1 2 3 4 5	**Air Breathing Engines (continuous combustion) jet engine With gas generator** -Turbo jet engines -Single pool -Twin pool
6 7 8 9	-By pass Engine -Front fan -Aft fan
10 11 12 13 14 15 16 17 18 19 20	-Turbo shaft Engines -Helicopter Engines -Turbo propeller By pass
21 22 23 24	**Without Gas generator** -Athodydes -Ram jet Engines -Pulse jet Engines

25 **26**	-Rockets -Solid fuel -Liquid fuel
27 **28** **29** **30**	**Intermittent combustion** **Internal combustion Engines** **Reciprocating Engines**

Subject Number: ANTE 326
Subject : Gas dynamic
Units:5
Weekly Hours : Theoretical :2
Experimental:1
Tutorial:1

Week	Contents
1	Introduction to Compressible Flow
2 3	Basic Equation of Compressible Flow Conservation of mass: Conservation of energy. Conservation of momentum. 1st law of thermodynamics. 2nd law of thermodynamics. Equation of State. Thermodynamics Relations.
4	Wave Propagation Wave formulation
5 6	Isentropic flow of a perfect gas in varying area duct Equations of motion. Stagnation concept and relations
7 8	Subsonic and Supersonic Flow through a Varying Area Channels Isentropic Table
9	Isentropic Flow in Converging Nozzles
10 11	Isentropic Flow in Converging–Diverging Nozzles

12	Thrust of Rocket Engine
13 14 15	Stationary Normal Shock Waves; partI Formation of a Normal Shock Wave Equations of Motion for a Normal Shock Wave
16 17 18	Stationary Normal Shock Waves; part 2 Area ratio Entropy Change Velocity Change
19	Normal shock in converging–diverging nozzles
20	Converging–Diverging Supersonic Diffusers
21	Supersonic Wind Tunnel
22 23	Moving Normal Shock Waves Reflected Waves. Shock Tube
24 25	Oblique Shock Waves Equations of Motion for a Straight Oblique Shock Wave Detached shock Wave Oblique Shock Reflections Conical Shock Waves Supersonic oblique Shock Diffuser.

26	Prandtl Meyer Flow Thermodynamic Considerations Gradual Compressions and Expansions Flow Equations for a Prandtl Meyer Expansion Fan
27	Plug, Underexpanded and Overexpanded Supersonic Nozzles Exit Flow for Underexpanded and Overexpanded Supersonic Nozzles Plug Nozzle
28	Supersonic Airfoils Supersonic lift and drag coefficients Existence of an Oblique Shock and an Expansion Fan.
29	Fanno flow-Part 1 Working Relations for Fanno Flow Reference state and Fanno Flow Table
30	Fanno Flow-Part 2 Fanno Flow line Friction factor Fanno Flow through a Nozzle-Duct System Converging–Diverging Nozzle and Duct Combination