JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in AERONAUTICAL ENGINEERING
COURSE STRUCTURE & SYLLABUS (R18)

Applicable From 2018-19 Admitted Batch

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA301BS	Probability and Statistics & Complex Variables	3	1	0	4
2	EE300ES	Basic Electrical and Electronics Engineering	3	0	0	3
3	AE303PC	Theory of Structures	3	0	0	3
4	AE304PC	Fluid Mechanics and Hydraulics	3	0	0	3
5	AE305PC	Aerodynamics - I	3	1	0	4
6	AE306PC	Mechanics of Solids Lab	0	0	2	1
7	AE307PC	Fluid Mechanics and Hydraulics Lab	0	0	4	2
8	EE309PC	Basic Electrical and Electronics Engineering Lab	0	0	2	1
9	*MC309	Constitution of India	3	0	0	0
		Total Credits	**18**	**2**	**8**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	AE401ES	Probability Distributions and Numerical Methods	3	1	0	4
2	AE402PC	Low Speed Aerodynamics	3	0	0	3
3	AE403PC	Aircraft Materials and Production	3	1	0	4
4	AE404PC	Analysis of Aircraft Structures	3	1	0	4
5	AE405PC	Aero-Thermodynamics	3	0	0	3
6	AE406ES	Aerodynamics Lab	0	0	2	1
7	AE407PC	Aerospace Structures Lab	0	0	2	1
8	AE408PC	Aircraft Materials and Production Lab	0	0	2	1
10	*MC409	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**3**	**8**	**21**

*MC – Satisfactory/Unsatisfactory

MA301BS: PROBABILITY AND STATISTICS & COMPLEX VARIABLES

B.Tech. II Year I Sem.   L   T/P/D C
                                                                         3   1/0/0   4

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn
- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper the student must be able to
- Formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.
- Analyse the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.

- Taylor's and Laurent's series expansions of complex function.

UNIT - I: Basic Probability   8 L
Probability spaces, conditional probability, independent events, and Bayes' theorem.
Random variables: Discrete and continuous random variables, Expectation of Random Variables, Moments, Variance of random variables

UNIT - II: Probability distributions   10 L
Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution
Continuous random variables and their properties, distribution functions and density functions,
Normal and exponential, evaluation of statistical parameters for these distributions

UNIT - III: Testing of Hypothesis   10 L
Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, types of errors, level of significance, critical region.
Large sample test for single proportion, difference of proportions, single mean, difference of means; small sample tests: Test for single mean, difference of means and test for ratio of variances

UNIT - IV: Complex Variables (Differentiation)   10 L
Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT - V: Complex Variables (Integration)   10 L
Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem, Conformal mappings, Mobius transformations and their properties.

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

REFERENCES:
1. Fundamentals of Mathematical Statistics, Khanna Publications, S. C. Gupta and V. K. Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

EE300ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech. II Year I Sem.
           L T/P/D C
           3 0/0/0 3

Course Objectives:
- To introduce the concepts of electrical circuits and its components.
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:
- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To introduce components of Low Voltage Electrical Installations
- To identify and characterize diodes and various types of transistors.

UNIT - I:
D.C. CIRCUITS
Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.
A.C. CIRCUITS
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits , Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II:
ELECTRICAL INSTALLATIONS
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - III:
ELECTRICAL MACHINES
Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

UNIT - IV:
P-N JUNCTION AND ZENER DIODE: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.
RECTIFIERS AND FILTERS: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - V:
BIPOLAR JUNCTION TRANSISTOR (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.
FIELD EFFECT TRANSISTOR (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:
1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCES:
1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

AE303PC: THEORY OF STRUCTURES

B.Tech. II Year I Sem.   **L   T/P/D   C**
                                                                               3   0/0/0   3

Course Objectives:
- Understand various aspects of mechanics of materials as applied to engineering problems in a systematic manner stressing the fundamentals.
- Analyze problems on thermal stresses, shear force, bending moment and deflection of beams
- Discuss the equilibrium and compatibility conditions for two-dimensional and three-dimensional elastic bodies.

Course Outcomes:
- Describe the types of loads , materials and properties of aircraft structures
- Calculate the response of statically determinate and indeterminate structures under various loading conditions
- Apply the theories of elasticity to predict failure of aircraft structures.

UNIT - I
Introduction: Mechanical properties of materials; Stresses and strains; Hooke's law, elastic constant, relation between modulii, working stress, factor of safety, poisons ratio ; bars of varying cross section; Thermal stresses. Torsion of solid and hollow circular shafts and shear stress variations; Power transmission in shafts; Shear force and bending moment diagrams for different types of beams with various loads.

UNIT - II
Stresses in Beams: Bending stresses and Shear stress variation in beams of symmetric and un-symmetric sections; Beams of uniform strength; Flexural stresses: Bending equations, calculation of bending stresses for different sections of beams like I, L, T, C, angle section.

UNIT - III
Beams and Columns: Deflection of beams by Double integration method, Macaulay's method, moment area method, conjugate beam method; Principle of superposition. Columns, types of columns, Euler's formula instability of columns, Rakine's and Jonson's formula, Eigen values and Eigen modes, concept of beam-column.

UNIT - IV
Redundant Structures: Trusses, perfect frames, analysis of trusses; Determinate and indeterminate structures, order of redundancy; Redundant analysis, analysis of determinate structures, area movement method, Clayperons method, slope deflection method, moment distribution method.

UNIT - V
Theory of Elastisity: Equilibrium and compatibility conditions and constitute relations for elastic solid and plane: generalized plane strain cases Airy's stress function Stress on inclined planes, stress transformations determination of principal stresses and strains by analytical method and graphical method - Mohr's circles and its constructions.

Text Books:
1. R. K Bansal, —Strength of Materialsǁ, Laxmi publications, 5th Edition, 2012.
2. T. H. G. Megson, —Aircraft Structures for Engineering Studentsǁ, Butterworth-Heinemann Ltd, 5th Edition, 2012.
3. Gere, Timoshenko, —Mechanics of Materialsǁ, McGraw Hill, 3rd Edition, 1993.

Reference Books:
1. Dym, C. L, Shames, I. H, —Solid Mechanics‖, McGraw Hill, Kogakusha, Tokyo, 7th Edition, 2007.
2. Stephen Timoshenko, —Strength of Materials‖, Vol I & II, CBS Publishers and Distributors, 3rd Edition, 2004.
3. R. K. Rajput, —Strength of Materials‖, S. Chand and Co., 1st Edition, 1999.
4. Timoshenko, S, Young, D. H. —Elements of Strength of Materials‖, T. Van Nostrand Co. Inc., Princeton N.J, 4th Edition, 1977.

AE304PC: FLUID MECHANICS AND HYDRAULICS

B.Tech. II Year I Sem.   L T/P/D C
                                                                 3 0/0/0   3

Course Objectives:
- Illustrate about the basic properties of a fluid, hydrostatic forces on submerged bodies and different manometers.
- Derive the basic principles of a fluid-continuity, momentum, Euler and Bernoulli's equations.
- Explain the concept of boundary layer theory and importance of Prandtl's boundary layer theory.
- Understand the flow through pipes and their losses for different geometries.

Course Outcomes:
- Basic fluid mechanics and description of fluid motion
- Various equations to solve fluid dynamics problems
- Concept of boundary layer

UNIT - I
Fluid Properties and Fluid Statics: Density, specific weight, specific gravity, surface tension and capillarity, Newton's law of viscosity, incompressible and compressible fluid, numerical problems; Hydrostatic forces on submerged bodies - Pressure at a point, Pascal's law, pressure variation with temperature and height, center of pressure plane, vertical and inclined surfaces; Manometers - simple and differential Manometers, inverted manometers, micro manometers, pressure gauges and numerical problems. Buoyancy - Archimedes principle, metacenter, Meta centric height calculations; Stability

UNIT - II
Fluid Kinematics and Basic Equations of Fluid Flow Analysis: Stream line, path line, streak line, stream surface, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent flows, one dimensional approximation, examples of real 1-D flows, two dimensional approximation, 2-D flow in wind tunnel; Continuity equations for 1-D and 2-D flows both compressible and incompressible, stream function for two dimensional incompressible flows; Vortices, irrotational flow, velocity potential function

UNIT – III:
Fluid Dynamics: Basic laws for a system in integral form: Reynolds transport theorem, Conservation of mass, Newton's 2nd law; Application of the basic laws for a control volume; Kinematics; Motion of a fluid particle; Fluid deformation; Differential analysis of fluid motion: Continuity equation, Differential momentum equation, Surface and body forces, substantive derivative, local derivative and convective derivative, momentum equation, Euler's and Bernoulli's equation, phenomenological basis of Naviers-stokes equation, introduction to vortex flows, flow measurements : pressure, velocity and mass flow rate, viscosity, pivot-static tube, venture meter and orifice meter, viscometers. Statement of Buckingham's π- theorem, similarity parameters - Reynolds number, Froude number, concepts of geometric, kinematic and dynamic similarity, Reynolds number as a very approximate measure of ratio of inertia force and viscous force.

UNIT - IV
Boundary Layer Theory and Pipe Flow: Boundary layer - introductory concepts of boundary layer, large Reynolds number flows and Prandtl's boundary layer hypothesis Pressure drag and skin friction drag; Pipe flow - Reynolds experiment, Darcy's equation, major and minor losses in pipes and numerical problems. Flow between parallel plates, flow through long tubes –fully developed flow, Turbulent flow, variation of friction factor with Reynolds's Number, Moody's chart.

UNIT - V

TURBO MACHINERY: Introduction and classification of fluid machines: Turbo machinery analysis; The angular momentum principle; Euler turbo machine equation; Velocity triangles; Application to fluid systems - Working principle overview of turbines, fans, pumps and compressors.

TEXT BOOKS:
1. Shames I H, ―Mechanics of Fluids‖, Kogakusha, Tokyo, 7th Edition, 2007.
2. R. K Bansal, ―Fluid mechanics and hydraulic machines‖, Laxmi publications ltd, 9th Edition, 2011.
3. Robert W Fox, Alan T McDonald, ―Introduction to fluid Mechanics‖, John Wiley and Sons, 6th Edition, 1995.
4. Streeter V. L, Wylie, E.B., ―Fluid Mechanics‖, McGraw-Hill, 9th Edition, 1983.

REFERENCE BOOKS:
1. Yuan S W, ―Foundations of fluid Mechanics‖, Prentice-Hall, 2nd Edition, 1987.
2. Milne Thompson L M, ―Theoretical Hydrodynamics‖, MacMillan, 5th Edition, 1968.
3. Ratha krishnan. E, ―Fundamentals of Fluid Mechanics‖, Prentice-Hall, 5th Edition, 2007.
4. Som S. K, Biswas. G ―Introduction to fluid mechanics and fluid machines‖, Tata McGraw-Hill, 2nd Edition, 2004

AE305PC: AERODYNAMICS – I

B.Tech. II Year I Sem.   **L T/P/D C**
Course Code: **3 1/0/0 4**

Course Objectives:
- Understand the basics of aerodynamics, aerofoil and wing characteristics
- Calculate forces and moments acting on aero foils and wings under ideal flow conditions.
- Design a propeller and determine aerodynamic interaction effects between different components of aircraft.

Course Outcomes:
- Theoretical Aerodynamics
- Conformal Transformation

UNIT - I
Introductory Topics for Aerodynamics: Properties of fluid, units, dimensions, form of matter, pressure, temperature, density, viscosity, specific heats and relations, enthalpy, entropy, atmosphere-ISA, types of flow, 1-D flow equations, conservation of mass, momentum, energy, equation of state, pressure coefficient.

UNIT - II
Potential Flow: Potential flow, velocity potential, stream function, Laplace equation, flow singularities-Uniform flow. source, sink, doublet, Vortex, Non lifting and lifting flow over a cylinder Kutta-Joukowski theorem. Magnus effect, circulation,

UNIT - III
Finite Wing Theory: Vortex motions, vortex line, vortex tube, vortex sheet; Circulation; Kelvin and Helmhotz theorem; Biot-Savart's law, applications, Rankine's vortex; Flow past finite wings, vortex model of the wing and bound vortices; Induced drag; Prandtl's lifting line theory; Elliptic wing. Influence of taper and twist applied to wings, effect of sweep back wings; Delta wings, primary and secondary vortex; Elements of lifting surface theory. Source Panel Vortex panel and Vortex lattice methods.

UNIT – IV
Flow Past Non-Lifting Bodies and Interference Effects: Flow past non lifting bodies, method of singularities; Wing-body interference; Effect of propeller on wings and bodies and tail unit; Flow over airplane as a whole.

UNIT - V
Conformal Transformation: Conformal transformation, Kutta-Zhukovasky transformation- circle to straight line, circle to ellipse, circle to symmetric aerofoil, circle to chambered aerofoil, circle to circular arc.

TEXT BOOKS:
1. E. L. Houghton and P. W. Carpenter, ―Aerodynamics for Engineering Studentsǁ, Edward Arnold Publishers Ltd., London, 5th Edition, 1982,
2. J. D. Anderson, ―Fundamentals of Aerodynamicsǁ, Mc Graw Hill Book Co., New York, 5th Edition, 1985.
3. John J. Bertin and Russell M. Cummings, ―Aerodynamics for Engineering Studentsǁ, Pearson, 5th Edition, 2009.

REFERENCE BOOKS:

1. L. J. Clancy, ―Aerodynamicsǁ, Pitman, 1st Edition, 1986.
2. L. H. Milne, S. Thomson, ―Theoretical Aerodynamicsǁ, Dover, 2nd Edition, 1985.
3. K. Karamcheti, ― Principles of Ideal-Fluid Aerodynamicsǁ, Krieger Pub Co; 2nd edition, 1980.

AE306PC: MECHANICS OF SOLIDS LAB

B.Tech. II Year I Sem.   **L T/P/D C**
Course Code: **0 0/2/0 1**

Course Objectives:
- Understand basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron.
- Adopt with the experimental methods to determine the mechanical properties of materials.

Course Outcomes:
- Identify microstructures and wear properties of engineering materials.
- Examine the defects in the materials by non-destructive testing
- Test the important mechanical properties of ferrous and non-ferrous materials.

List of Experiments:
1. **Brinell Hardness Test:** Determination of Brinell number of a given test specimen.
2. **Rockwell Hardness Test:** Determination of hardness number of different specimens such as steel, brass, copper and aluminum.
3. **Tension Test:** Study the behavior of mild steel and various materials under different loads. To determine
   a) Tensile
   b) Yield strength
   c) Elongation
   d) Young 's modulus
4. **Torsion Test:** Determine of Modulus of rigidity of various specimens.
5. **Izod Impact Test:** Determination the toughness of the materials like steel, copper, brass and other alloys using Izod test
6. **Charpy Impact Test:** Determine the toughness of the materials like steel, copper, brass and other alloys using Charpy test.
7. **Compression Test on Short Column:** Determine the compressive stress on material.
8. **Compression Test on Long Column:** Determine Young 's modulus of the given long column.
9. **Testing of Springs: Determine** the stiffness of the spring and the Modulus of rigidity of wire material.
10. **Deflection Test For SSB And Cantilever Beam: Determine** the Young's modulus of the given material with the help of deflection of SSB and cantilever beam

Reference Books:
1. Gere, Timoshenko, ―Mechanics of Materials‖, McGraw Hill, 3rd Edition, 1993.
2. R. S Kurmi, Gupta, ―Strength of Materials‖, S. Chand, 24th Edition, 2005.
3. William Nash, ―Strength of Materials‖, Tata McGraw Hill, 4th Edition, 2004.

AE307PC: FLUID MECHANICS AND HYDRAULICS LABORATORY

B.Tech. II Year I Sem.   **L T/P/D C**
Course Code: **0 0/4/0 2**

Course Objectives:
- Gain knowledge on working of centrifugal pumps, positive displacement pumps, hydraulic turbines centrifugal blowers and steam turbines.
- Compare performance of various machines at different operating points.
- Knowledge of various flow meters and the concept of fluid mechanics.

Course Outcomes:
- Obtain the necessary practical skills & real time knowledge
- Apply scientific method for analysing the qualitatively & quantitatively to solve the problems.
- Flow behaviour in various geometry of cross sectional

List of Experiments:
1. **Calibration:** Calibration of Venturi meter and orifice meter.
2. **Pipe Flow Losses:** Determination of pipe flow losses in rectangular and circular pipes
3. **Bernoulli's Theorem:** Verification of Bernoulli's theorem.
4. **Reynolds Experiment:** Determination of Reynolds Number of fluid flow
5. **Impact of Jet on Vanes:** Study Impact of jet on Vanes.
6. **Centrifugal Pumps:** Performance test on centrifugal pumps.
7. **Reciprocating Pumps:** Performance test on reciprocating pumps.
8. **Pelton Wheel Turbine:** Performance test on piston wheel turbine.
9. **Francis Turbine:** Performance test on Francis turbine.
10. **Flow Through Weirs:** Rate of discharge Flow through Weirs
11. **Flow Through Notch:** Flow through rectangular and V-Notch
12. **Flow Though Orifice Mouth Piece:** Flow analysis of different shapes of mouth pieces

REFERENCE BOOKS:
1. Yuan S W, ―Foundations of fluid Mechanics‖, Prentice-Hall, 2nd Edition, 1987.
2. Milne Thompson L M, ―Theoretical Hydrodynamics‖, MacMillan, 5th Edition, 1968.
3. Rathakrishnan. E, ―Fundamentals of Fluid Mechanics‖, Prentice-Hall, 5th Edition, 2007.
4. Som S. K., Biswas. G, ―Introduction to fluid mechanics and fluid machines‖, Tata McGraw-Hill, 2nd Edition, 2004.

EE309PC: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

B.Tech. II Year I Sem.   **L T/P/D C**
                                                                                   0 0/2/0 1

Pre-requisites: Basic Electrical and Electronics Engineering
Course Objectives:
- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:
- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To introduce components of Low Voltage Electrical Installations
- To identify and characterize diodes and various types of transistors.

List of experiments/demonstrations:

PART A: ELECTRICAL
1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
   (ii) Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

PART B: ELECTRONICS
1. Study and operation of
   (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB / CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

TEXT BOOKS:
1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCES:
1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.

4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

*MC309/*MC409: CONSTITUTION OF INDIA

B.Tech. II Year I Sem.   **L   T/P/D   C**
                                                                           3   0/0/0   0

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content
1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

AE401ES: PROBABILITY DISTRIBUTIONS AND NUMERICAL METHODS

B.Tech. II Year II Sem.	**L**	**T/P/D**	**C**
	3	**1/0/0**	**4**

Pre-requisites: Mathematics courses in first two years of study
Objectives: To learn
- Most of the random situations are described as functions of many single random variables. In this unit, the objective is to learn functions of many random variables through joint distributions and ANOVA
- The random processes, The classification of random processes, Markov chain, Classification of states
- Stochastic matrix (transition probability matrix) Limiting probabilities, Applications of Markov chains
- Various methods to find the roots of an equation
- Fitting linear, non- linear and exponential curves for the given data.
- The concept of interpolation and fitting a interpolating polynomial.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Finding the derivatives and proper integrals of given functions using finite differences.
- Solving ordinary differential equations using numerical techniques.

Course outcomes: After learning the contents of this paper the student must be able to
- Formulate and solve problems involving the multiple random variables and the ANOVA for analysing the experimental data.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in n^{th} state.
- Find a better approximate root of a given equation.
- Fit a linear, non-linear and exponential curve for the given data.
- Find the finite difference operators in a given data or value of the dependent variable for a given independent variable
- Evaluate the derivative at a given value and integral of a function.
- Solve the initial value problems.

UNIT - I: Multiple Random variables, Correlation & Regression
Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables- ANOVA for one-way classified data.

UNIT - II: Stochastic processes
Introduction to Stochastic Processes –Classification of Random processes, Methods of description of random processes-Stationary and non-stationary random process-Average values of single random process and two or more random processes. Markov process, Markov chain, classification of states – Examples of Markov Chains, Stochastic Matrix.

UNIT - III: Solution of Algebraic, Transcendental Equations and Curve fitting
Bisection method, Regula-Falsi method, Iteration method, Newton-Raphson method.
Curve Fitting: Method of least squares**,** Fitting a straight line, Second degree parabola and Non-linear curves of the form $y = ae^{bx}$, $y = ab^{x}$, $y = ax^{b}$ by the method of least squares.

UNIT - IV: Interpolation and Numerical Differentiation
Finite differences: Forward, Backward and Central differences, - Newton's interpolation formulae, Central difference interpolation formulae: Gauss's forward and backward interpolation formulae, Interpolation with unequal intervals: Lagrange's interpolation formula.
Numerical differentiation: Derivatives using Newton's interpolation formulae.

UNIT - V: Integration and Solution of Ordinary Differential Equations of First Order
Trapezoidal rule Simpson's 1/3rd and 3/8th rule- Solution of ordinary differential equations by Taylor's series, Picard's method of successive approximations, Euler's method, Runge-Kutta method (second and fourth order)

TEXT BOOKS:
1. Probability and Statistics for Engineers and Scientists by Sheldon M Ross, Academic Press
2. S S Sastry, Introductory Methods of Numerical Analysis, Fifth Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

REFERENCES:
1. T. T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. B V Ramana, Higher Engineering Mathematics, Tata McGraw Hill Education Private Limited, New Delhi, 29th Reprint, 2017

AE402PC: LOW SPEED AERODYNAMICS

B.Tech. II Year II Sem.   **L T/P/D C**
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Course Objectives:
- Understand the basics of aerodynamics, aerofoil and wing characteristics
- Calculate forces and moments acting on aero foils and wings under ideal flow conditions.
- Design a propeller and determine aerodynamic interaction effects between different components of aircraft.

Course Outcomes:
- Introduction to Low speed aerodynamics
- Aerofoil and wing Theory
- Concept of boundary layers

UNIT - I
Aerofoil and Wing: Forces and moments on aircraft, wing platform geometry, Aerofoil nomenclature, aerodynamic characteristics, centre of pressure and aerodynamic centre; Wing of infinite aspect ratio, generation of lift, starting Vortex, Kutta's trailing edge condition, pressure distribution on aerofoil,

UNIT - II
Forces and Moments on Aircraft: Types of drag, wake, Estimation of lift, drag and pitching moment coefficient from pressure distribution, Aerofoil characteristics, C_l vs Angle of attack. Aspect ratio effect on C_l curve, C_l vs C_d, pitching moment coefficient, Steady level flight, wing loading, drag polar.
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UNIT – III:
Propellers and Propulsion: Froudes momentum theory of propulsion, Airscrew, airscrew pitch, geometric Pitch, mean pitch, vortex system of an airscrew, performance of blade, actuator disc in hovering flight.

UNIT - IV
Introduction to Steady Flight Performance: Types of drag, minimum drag condition in level flight, power, conditions of minimum power requirements, - gliding flight, rate of sink, range, - Climbing flight, condition for maximum rate of climb, rate of turning.

UNIT - V
Boundary Layer Theory: Introduction to boundary layer, laminar and turbulent boundary layer, transition, boundary layer on flat plate, displacement thickness, momentum thickness, energy thickness, effect of curvature, temperature boundary layer.

TEXT BOOKS:
1. E. L. Houghton and P. W. Carpenter, —Aerodynamics for Engineering Studentsǁ, Edward Arnold Publishers Ltd., London, 5th Edition, 1982,
2. J. D. Anderson, —Fundamentals of Aerodynamicsǁ, Mc Graw Hill Book Co., New York, 5th Edition, 1985.
3. John J. Bertin and Russell M. Cummings, —Aerodynamics for Engineering Studentsǁ, Pearson, 5th Edition, 2009.

Reference Books:
1. L. J. Clancy, —Aerodynamicsǁ, Pitman, 1st Edition, 1986.
2. L. H. Milne, S. Thomson, —Theoretical Aerodynamicsǁ, Dover, 2nd Edition, 1985.
3. K. Karamcheti, — Principles of Ideal-Fluid Aerodynamicsǁ, Krieger Pub Co; 2nd edition, 1980.

AE403PC: AIRCRAFT MATERIALS AND PRODUCTION

B.Tech. II Year II Sem.   L T/P/D C
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course objectives:
- Study the composition of microstructures of metals and alloys with their applications in aerospace industry.
- Discuss the various manufacturing processes and selection of process for suitable applications.
- Understand the working principles and applications of conventional and unconventional machining along with their advantages and disadvantages.
- Demonstrate the importance of composites with their applications in different areas of aerospace industry.

Course Outcomes:
- Describe the basics of manufacturing processes, techniques, and quality process.
- Composite material, properties and characteristics.

UNIT - I
Aircraft Engineering Materials: Engineering materials Steels, study of iron, iron carbon phase diagram, heat treatment-annealing, normalizing, hardening and tempering of Aluminum and steel, Non-Ferrous metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Corrosion - Types of Corrosions - Prevention – Protective Treatments.

UNIT - II
Casting, Welding and Inspection Techniques: General principles of various casting processes Sand casting, die-casting, centrifugal casting, investment casting, Shell molding types; Principles and equipment used in arc welding, gas welding, resistance welding, solid, laser welding, and electron beam welding, soldering and brazing techniques. Need for NDT, ultrasonic testing, Radiographic testing, Flight testing.

UNIT - III
Sheet Metal Processes in Aircraft Industry: Sheet metal operations: shearing, punching, super plastic forming; operations in bending like stretch forming spinning drawing. Riveting, types and techniques, equipment, fasteners, integral tanks, final assembly of aircraft, Jigs and Fixtures, stages of assembly, aircraft tooling concepts.

UNIT - IV
Conventional and Unconventional Machining Processes: General working principles, applications and operations of lathe, shaper, milling machines, grinding, drilling machine, computer numeric control machining. Working principles and applications of abrasive jet machining, ultrasonic machining, Electric discharge machining and electro chemical machining, laser beam, electron beam, plasma arc machining.

UNIT - V
Aircraft Composites: Introduction, Physical metallurgy, Wrought aluminum alloys, Cast aluminum alloys, Production of semi-fabricated forms, Aerospace applications, Plastics and rubber, Introduction to fiber reinforced plastics, glass and carbon composites; Fibers and resins; Characteristics and applications, Classification of aircraft materials; Materials used for aircraft components, Application of composite materials, Super alloys, indigenized alloys, emerging trends in aerospace materials

TEXT BOOKS:
1. S. Kalpakjian, Steven R. Schmid, ―Manufacturing Engineering and Technology‖, Addison Wesley 5th Edition, 1991.
2. S. C. Keshu, K. K Ganapathy, ―Aircraft production technology and management‖, Interline Publishing House, Bangalore, 3rd Edition, 1993.
3. Douglas F. Horne, ―Aircraft production technology‖, Cambridge University Press, 1st Edition, 1986.

REFERENCE BOOKS:
1. S. C. Keshu, K. K Ganapathy, ―Air craft production techniques‖, Interline Publishing House, Bangalore, 3rd Edition, 1993.
2. R. K. Jain, ―Production technology‖, Mc Graw Hill, 1st Edition, 2002.
3. O. P. Khanna, M. Lal, ―Production technology‖, Dhanpat Rai Publications, 5th Edition, 1997.

AE404PC: ANALYSIS OF AIRCRAFT STRUCTURES

B.Tech. II Year II Sem.	**L T/P/D C**
	3 1/0/0 4

Pre-Requisites: Theory of Structures

Course Objectives:
- Understand the aircraft structural components and its behavior under different loading conditions.
- Obtain knowledge in plate buckling and structural instability of stiffened panels for airframe structural analysis.
- Explain the thin walled section and structural idealization of panels and differentiate from the type of loads carried.
- Solve for stresses and deflection in aircraft structures like fuselage, wing and landing gear.

Course Outcomes:
- Types of structure used in aircraft and various loads experienced by components

UNIT - I
Introduction to Aircraft Structural Components and Energy Methods: Aircraft Structural components and loads, functions of structural components, airframe loads; Types of structural joints, type of loads on structural joints; Aircraft inertia loads; Symmetric manoeuvre loads, gust loads. Monocoque and semi monocoque structures, stress in thin and thick shells; Introductions to energy principles, Castilians theorems, Maxiwells reciprocal theorem, unit load method, Rayleigh Ritz method, total potential energy method, flexibility method.

UNIT - II
Thin Plate Theory, Structural Instability: Analysis of thin rectangular plates subject to bending, twisting, distributed transverse load, combined bending and in-plane loading: Thin plates having small initial curvature, energy methods of analysis. Buckling of thin plates: Elastic, inelastic, experimental determination of critical load for a flat plate, local instability, instability of stiffened panels, failure stresses in plates and stiffened panels. Tension field beams- complete diagonal tension, incomplete diagonal tension, post buckling behaviour.

UNIT - III
Bending, Shear and Torsion of Thin Walled Beams: Unsymmetrical bending: Resolution of bending moments, direct stress distribution, position of neutral axis; Deflections due to bending: Approximations for thin walled sections, temperature effects; Shear loaded thin walled beams: General stress, strain and displacement relationships, direct stress and shear flow system, shear centre, twist and warping. Torsion of beams of closed section: Displacements associated with Bredt-Batho shear flow; Torsion of open section beams; Warping of cross section, conditions for zero warping; Bending, shear, torsion of combined open and closed section beams.

UNIT - IV
Structural Idealization: Structural idealization: Principal assumptions, idealization of panel, effect on the analysis of thin walled beams under bending, shear, torsion loading- application to determining deflection of open and closed section beams. Fuselage frames - bending, shear and torsion.

UNIT – V
Analysis of Fuselage, Wing and Landing Gear: Wing spar and box beams, tapered wing spar, open and closed sections beams, beams having variable stringer areas; wings – three boom shell in bending, torsion and shear, tapered wings, deflections, cutouts in wings; Cutouts in fuselages;

Fuselage frame and wing rib; principle of stiffener, web constructions. Landing gear and types; Analysis of landing gear.

TEXT BOOKS:
1. T. H. G. Megson, ―Aircraft Structures for Engineering Studentsǁ, Butterworth-Heinemann Ltd, 5th Edition, 2012.
2. E. H. Bruhn, ―Analysis and Design of Flight vehicles Structuresǁ, Tri-state off set company, USA, 4th Edition, 1965.

REFERENCE BOOKS:
1. B. K. Donaldson, ―Analysis of Aircraft Structures - An Introductionǁ, Mc Graw Hill, 3rd Edition, 1993.
2. S. Timoshenko, ―Strength of Materials, Vols I and IIǁ, Princeton D. Von Nostrand Co., Reprint, 1977.

AE405PC: AERO - THERMODYNAMICS

B.Tech. II Year II Sem.

L T/P/D C
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Course Objectives:
- To introduce fundamental concepts in thermodynamics, heat transfer, and refrigeration and air conditioning. apply mathematical foundations, principles in solving thermodynamics problems.

Course Outcomes:
- This course provides the basic knowledge about thermodynamic laws and relations, and their application to various processes**.**

UNIT - I
First Law of Thermodynamics: Concept of continuum-Macroscopic approach-thermodynamic systems-properties-state, path and process, quasi-static process- work and heat-zeroth law and first law of thermodynamics-internal energy-enthalpy- applications of first law of thermodynamics to closed and open system.

UNIT - II
Second Law of Thermodynamics: Second law of thermodynamics-Kelvin's and Clausius statements of second law-reversibility and irreversibility-carnot theorem-carnot cycle- reversed Carnot cycle-clausius inequality-concept of entropy-principle of energy-availability and unavailability-Exergy for closed and an open systems.

UNIT - III
Properties of Pure Substances and Power Cycle: Properties of pure substances-Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, H-S diagrams, PVT surfaces thermodynamics properties of steam, calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and Regeneration cycle.

UNIT - IV
Air Standard Cylces and IC Engines
Cycle-air standard efficiency-Otto cycle-diesel cycle- dual cycle- Brayton cycle-components of IC engines-Two stroke and four stroke cycle engine-performance of IC engine-supercharging.

UNIT - V
Refrigeration, Air Conditioning and Psychrometry: Concepts of psychrometry, Psychrometric relation and charts-processes-Refrigeration systems-Air-conditioning systems and its types- simple vapour compression system-vapour absorption system-Refrigerants.

TEXT BOOKS:
1. Nag. P.K., "Engineering Thermodynamics", McGraw Hill Education (India) Private Limited; Fifth edition, April 2013.
2. Rathakrishnan E, "Fundamentals of Engineering Thermodynamics", Prentice Hall India, 2 revised edition 2005.
3. Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach" McGraw-Hill Science/Engineering/Math; 7thedition 2010.

REFERENCE BOOKS:
1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.

3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004

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AE406ES: AERODYNAMICS LAB

B.Tech. II Year II Sem.   **L T/P/D C**
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Pre-Requisites: Aerodynamics-1 and Low Speed Aerodynamics

Course Objectives:
- Understand the behavior of flow properties over different models using subsonic wind tunnel.
- Demonstrate experimentally the pressure distribution over circular, symmetric and cambered airfoils and evaluate lift and drag.
- Illustrate flow visualization studies at low speeds over different aerodynamic bodies.

Course Outcomes:
- Point out the pressure distribution of symmetrical and unsymmetrical airfoil and 2D cylinder.
- Examine flow visualization of airfoil and bluff bodies

List of Experiments
1. Calibration of subsonic wind tunnel.
2. Pressure Distribution-Cylinder
3. Pressure Distribution-Symmetric Airfoil
4. Pressure Distribution-Cambered Airfoil
5. Force measurement using wind tunnel balance.
6. Flow over a Flat Plate
7. Flow visualization studies in low speed over cylinder
8. Flow Visualization Studies - Airfoil Flow visualization studies in low speed over airfoil at different angles of incidence.
9. Wake analysis over a cylinder and airfoils
10. Blower Test Rig; Efficiency of blower test rig for 3 different vane settings.
11. Axial Flow Compressor; Efficiency of axial flow compressor
12. Centrifugal Flow Compressor

Reference Books:
1. L. J. Clancy, ―Aerodynamics", Pitman, 1st Edition, 1986.
2. Alan pope, ― Low Speed Wind Tunnel Testing‖, John Wiley, 2nd Edition, 1999.
3. N. M. Komerath, ―Low Speed Aerodynamics‖, Extrovert, 1st Edition, 2012.

AE407PC: AEROSPACE STRUCTURES LAB

B.Tech. II Year II Sem.   L T/P/D C
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Pre-Requisites: Theory of Structure

Course Objectives:
- Provide basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron.
- Visualize the crack detection using various NDT methods and also discuss the changing strength due to these defects.
- Understand the concept of locating the shear centre for open and closed section of beams.
- Obtain buckling strength of both long and short columns using different elastic supports.

Course Outcomes:
- Various load testing methodology and selecting the suitable structure for different components

LIST OF EXPERIMENTS
1. Direct Tension Test; Tensile testing using UTM, mechanical and optical extensometers, stress strain curves and strength test or various engineering materials.
2. Deflection Test ; Stress and deflections of beams for various end conditions, verification of Maxwell's theorem
3. Buckling Test; Compression tests on long columns, Critical buckling loads.
4. Buckling Test; Compression tests on short columns, Critical buckling loads, south well plot.
5. Bending Test; Unsymmetrical Bending of a Beam.
6. Shear Centre for Open Section; Shear Centre of an open Section beam.
7. Shear Centre for Closed Section; Shear Centre of a closed Section beam.
8. Wagner's Theorem; Wagner beam – Tension field beam.
9. Sandwich Panel Tension Test; Fabrication and determine the young's modulus of a sandwich structures.
10. Non-Destructive Testing ; Study of non-destructive testing procedures using dye penetration,
11. Non-Destructive Testing; Magnetic particle inspection and ultrasonic techniques.
12. Vibration Test; Determination of natural frequency of beams under free and forced vibration using.

REFERENCE BOOKS:
1. Megson, T.H.G., Aircraft Structures for Engineering Students, 4th edn., Elsevier, 2007, ISBN 0-750-667397.
2. Peery, D.J. and Azar, J.J., Aircraft Structures, 2ndedn, McGra-Hill, 1982, ISBN 0-07-049196-8.
3. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, Tri-state Off-set Company, USA, 1965.
4. Lakshmi Narasaiah, G., Aircraft Structures, BS Publications, 2010.

AE408PC: AIRCRAFT MATERIALS AND PRODUCTION LAB

B.Tech. II Year II Sem.   **L T/P/D C**
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Course Objectives:
- Understand the basic conventional machining operation using for aircraft structural members production.
- Illustrate other unconventional machining techniques required for aircraft production.
- Perform the basic computer numerical control machining operation required for aircraft production technology.

Course Outcomes:
- Operate the various machines used in production, different welding techniques

List of Experiments
1. **Basic Metallurgy - I:** Preparation and study of microstructure of pure materials like Cu and Al. Hardenability of steels by Jominy End Quench test
2. **Basic Metallurgy - II:** Study of microstructures of non-ferrous alloys. Study of microstructure of heat treated steel.
3. **Lathe Operations :** Introduction- lathe machine, plain turning, Step turning & grooving, Taper turning-compound rest/offset method & Drilling using lathe, External threading-Single start
4. **Shaping & Slotting;** Shaping-V-Block & Slotting-Keyways.
5. **Grinding & Milling:** Grinding-Cylindrical /Surface/Tool & cutter. Milling-Polygon /Spur gear.
6. **Drilling;** Drilling, reaming, counter boring, Counter sinking Taping.
7. **Cnc Machining;** Basic operations, Introduction to CNC programming.
8. **Welding Processes I;** Gas Welding, Brazing, Electric and Black smithy, Soldering.
9. **Welding Process II;** Arc welding. Spot welding, Seam welding, TIG welding and MIG Welding.
10. **Basic Casting;** Sand Casting using different patterns (any two).
11. **Riveting Aluminium Sheets;** Spot and Blind Rivets on aluminium sheets

REFERENCE BOOKS:
1. Keshu S. C, Ganapathy K. K, ―Air craft production techniques‖, Interline Publishing House, Bangalore, 3rd Edition, 1993.
2. R. K Jain-Khanna, ―Production technology‖, Mc Graw Hill, 1st Edition, 2002.
3. O. P Khanna, Lal. M. Dhanpat Rai, ―Production technology, 5th Edition, 1997.

*MC409/*MC309: GENDER SENSITIZATION LAB
(An Activity-based Course)

B.Tech. II Year II Sem.

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COURSE DESCRIPTION

      This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

      This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course:
- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:
- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I: UNDERSTANDING GENDER
Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men
- Preparing for Womanhood. Growing up   Male. First   lessons in Caste.

UNIT – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

UNIT – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: **Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.**

- ➢ *Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".*

- ☞ **ESSENTIAL READING**: The Textbook, "*Towards a World of Equals: A Bilingual Textbook on Gender" written* by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**

ASSESSMENT AND GRADING:
- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%