SEMESTER I

Course Code		Credits :3
USARM 101	**BASIC AERODYNAMICS**	
Unit I -Aerodynamics : Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient,Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.		**20 Lectures**
Unit II -Theory of Flight: Relationship between lift, weight, thrust and drag; Glide ratio; Steady state flights, performance; Theory of the turn; Influence of load factor: stall, flight envelope and structural limitations; Lift augmentation.		**20 Lectures**
Unit III -Flight Stability and Dynamics: International Standard Atmosphere (ISA), application to aerodynamics. Longitudinal, lateral and directional stability (active and passive).		**20 Lectures**
Reference Book :- Mechanics of flight by A C Kermode		

Course Code		Credits :3
USARM 102	**ELECTRICAL FUNDAMENTALS**	
Unit I:Static Electricity and Conduction: Static electricity and distribution of electrostatic charges; Electrostatic laws of attraction and repulsion; Units of charge, Coulomb's Law; Conduction of electricity in solids, liquids, gases and a vacuum. **Electrical Terminology** The following terms, their units and factors affecting them: potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow. **Generation of Electricity** Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion. **DC Sources of Electricity** Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells. **DC Circuits** Ohms Law, Kirchoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply.		**30 Lectures**

Unit II: Resistive (R), Capacitive (C) and Inductive (L) Circuits : **Inductance/Inductor** Faraday's Law; Action of inducing a voltage in a conductor moving in a magnetic field; Induction principles; Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductor turns; Mutual induction; The effect the rate of change of primary current and mutual inductance has on induced voltage; Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other; Lenz's Law and polarity determining rules; Back emf, self induction; Saturation point; Principle uses of inductors; **Resistance/Resistor** Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge; **Power** Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy, **Capacitance/Capacitor** Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors. Phase relationship of voltage and current in L, C and R circuits, parallel, series and series parallel; Power dissipation in L, C and R circuits; Impedance, phase angle, power factor and current calculations; True power, apparent power and reactive power calculations. **Magnetism** Theory of magnetism; Properties of a magnet Action of a magnet suspended in the Earth's magnetic field; Magnetisation and demagnetisation; Magnetic shielding; Various types of magnetic material; Electromagnets construction and principles of operation; Hand clasp rules to determine: magnetic field around current carrying conductor. Magnetomotive force, field strength, magnetic flux density, permeability, hysteresis loop, retentivity, coercive force reluctance, saturation point, eddy currents; Precautions for care and storage of magnets.	**30 Lectures**

Unit III : Motors and Generators: **DC Motor/Generator Theory** Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction. **AC Theory** Sinusoidal waveform: phase, period, frequency, cycle; Instantaneous, average, root mean square, peak, peak to peak current values and calculations of these values, in relation to voltage, current and power Triangular/Square waves; Single/3 phase principles. **Transformers** Transformer construction principles and operation; Transformer losses and methods for overcoming them; Transformer action under load and no-load conditions; Power transfer, efficiency, polarity markings; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers. **Filters** Operation, application and uses of the following filters: low pass, high pass, band pass, band stop. **AC Generators** Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators. **AC Motors** Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.	**30 Lectures**
Reference Book : **1.** Aircraft Electricity and Electronic by Eismen (Chapter 3,6,10,11,12,13) **2.** Examples in electrical Calculation by Admirality **3.** Electrical technology by B L Theraja (Volume 2)	

Course Code		Credits :3
USARM 103	**ELECTRONIC FUNDAMENTALS**	
Unit I –Semiconductors: Diode symbols; Diode characteristics and properties; Diodes in series and parallel; Main characteristics and use of silicon controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes; Functional testing of diodes. Materials, electron configuration, electrical properties; P and N type materials: effects of impurities on conduction, majority and minority characters; PN junction in a semiconductor, development of a potential across a PN junction in unbiased, forward biased and reverse biased conditions; Diode parameters: peak inverse voltage, maximum forward current, temperature, frequency, leakage current, power dissipation; Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers; Detailed operation and characteristics of the following devices: silicon controlled rectifier (thyristor), light emitting diode, Shottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode.		**30 Lectures**
Unit II –Transistors : Transistor symbols; Component description and orientation; Transistor characteristics and properties. Construction and operation of PNP and NPN transistors; Base, collector and emitter configurations; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilisation; Multistage circuit principles: cascades, push-pull, oscillators, multivibrators, flip-flop circuits. **Integrated Circuits:** Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback. Description and use of printed circuit boards.		**30 Lectures**
Unit III – Servomechanisms : Understanding of the following terms: Open and closed loop systems, feed-Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, transformers, inductance and capacitance transmitters. Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, dead band; Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, synchronous transmitters;Servomechanism defects, reversal of synchro leads, hunting.		**30 Lectures**

Reference Book :

1. Digital Principles and Applications by DONALD P. LEACH, ALBERTPAUL ALVINO,GOUTAM SAHA
2. Aircraft Instruments system by E H J Pallet

Course Code		Credits :3
USARM 104	**MAINTENANCE PRACTICES**	
Unit I -Workshop Practices : Common hand tool types; Common power tool types; Operation and use of precision measuring tools; Lubrication equipment and methods. Operation, function and use of electrical general test equipment; Operation, function and use of avionic general test equipment. Care of tools, control of tools, use of workshop materials; Dimensions, allowances and tolerances, standards of workmanship; Calibration of tools and equipment, calibration standards. Operation, function and use of avionics general test equipments.		**20 Lectures**
Unit II-Hardware : Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Identification of wire types, their inspection criteria and damage tolerance. Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding. EWIS installations, inspection, repair, maintenance.		**20 Lectures**
Unit III–Pipes and safety precautions : Types of solid and blind rivets: specifications and identification, heat treatment. Rivnut, special non blind rivets. Riveted joints, rivet spacing and pitch; Inspection of riveted joints. Bending and belling / flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses Installation and clamping of pipes, Inspection and testing of springs, Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals. Also, instruction in the remedial action to be taken in the event of a fire or another accident with one or more of these hazards including knowledge on extinguishing agents.		**20 Lectures**
Reference Book :- 1. FAA-H-8083-30(9A) & 15 A 2. Shop Theory (Anderson) 3. A/C powerplant – Kroes and Wild		

Course Code		Credits :4
USARM 105	**Communication**	
Unit I–Reading, Comprehension skills and vocabulary development : Abstracting and summarizing skills, Concepts of functional and reading vocabulary, Importance of vocabulary and its enhancement, Developing effective conversational skills, Oral and written expression of ideas.		**20 Lectures**
Unit II–Professional skill Professional skill development, writing: – letter writing, report writing, speaking & listening: – discussion, debates. Seven C's of effective communication		**20 Lectures**

Unit III – Human rights: Human rights constituents with special reference to Fundamental Rights in India	**20 Lectures**
Reference Book :- Human Rights and communication skills by Basantrani	

PRACTICAL

Course Code	PRACTICALS	Credits : 1
USARM1P1	**ENGINEERING DRAWING**	50 marks
Use of Drawing Instruments, Lines & lettering. Construction of parabola, ellipse, hyperbola. First and Third angle projections Technology, orthographic, Isometric oblique perspective.		**60 hours**

Course Code	PRACTICALS	Credits :1
USARM 1P2	**MAINTENANCE PRACTICES**	50 marks
1. Identifying different parts of aircraft. And their operation on aircraft. 2. Measure the length using micrometer 3. Measure the length using vernier caliper 4. Single patch riveting 5. Double patch riveting 6. Lap Joint by Riveting. 7. Butt joint by Riveting. 8. Make a rectangular doubler 9. Make a circular doubler 10. To study use of torque wrenches 11. To study use of spanners. 12. To study use of pliers		**60 hours**

Course Code	PRACTICALS	Credits :1
USARM 1P3	**ELECTRICAL FUNDAMENTALS**	50 marks
1. Use of multimeter 2. Measurement of AC voltage 3. Measurement of DC voltage 4. Measurement of resistance 5. Measurement of resistance with color band 6. Measurement of resistance in series 7. Measurement of resistance in parallel 8. Verify ohms law 9. Verify kirchoff's voltage law 10. Verify kirchoff's current law 11. Working of Relays and solenoids 12. Connection of battery cells in series and parallel 13. Familiarization with transformers 14. Measurement of output voltage of DC generator 15. Working of DC motor' 16. Measurement of output voltage of alternator		**60 hours**

Course Code	**PRACTICALS**	Credits :1
USARM 1P4	**ELECTRONIC FUNDAMENTALS**	50 marks
1) Identification of components of R, L, C and measure values 2) Study of the features and controls of CRO & Multi meter 3) Study of Operating Controls of Voltmeter, Ammeter, Power meter, Ohm meter, DMM for its use 4) Study the characteristics of Electron Tube 5) Identification of Semiconductor devices – Diodes, Transistors and perform their characteristics 6) Study of SCR and its characteristics and waveform 7) Study of Zener diode and its characteristics and waveform 8) Study the working of Half wave, Full wave, Bridge Rectifier and observe the waveform 9)To check UJT transistor and perform its characteristics 10) To observe the performance of choke input and capacitance input filter after the rectification circuit		**60 hours**

SEMESTER II

Course Code		Credits :3
USARM 201	**PHYSICS**	
Unit I–Basic Physics : Mass, Centre of Gravity, Work, Energy, Power, Pressure, stress, Torque, Elasticity of Material, Speed, Velocity, Newton's laws of motion, Principle of the Gyroscope. Friction, Viscosity, Fluid Resistance, Specific Gravity, Pressure & Buoyancy in liquids, kinetic Theory of gases, Speed of sound		**20 Lectures**
Unit II –Thermodynamics and Laws : Heat & Energy, Conversion, Thermodynamics, Charle's and Boyle's laws, Heat Transfer, Specific Heat, Absolute and relative humidity, Vapour locks, calorific values of fuels		**20 Lectures**
Unit III –Fluid dynamics : Dynamics of fluid, Pascal's law & its application in Hydraulic press, Hydraulic and Pneumatic system. Bernoulli's law, Venturi tube theory, Streamline, Laminar and turbulent flow.		**20 Lectures**
Reference Book :- FAA 9A		

Course Code		Credits :3
USARM 202	**AVIATION LEGISLATION**	
Unit I: Regulatory framework. Role of ICAO; the aircraft act and rule made there under; role of DGCA; relationship between CAR-21, CAR-M, CAR-145, CAR-66, the aircraft rules (applicable to aircraft maintenance and release); aeronautical information circulars (applicable to aircraft maintenance and release); CAR section 1 and 2.		**30 Lectures**
Unit II:CAR- 66, CAR 145 and Aircraft operations **CAR 66** **Certifying staff maintenance** Detailed understanding of CAR-66. **CAR 145 – Approved maintenance organizations** Detailed understanding of CAR 145 and CAR M subpart F. **Aircraft Operations** Commercial air transport/ Commercial operations Air operators certificate; Operator's responsibilities, in particular regarding continuing airworthiness and maintenance; Documents to be carried on board; aircraft playcarding (Markings)		**30 Lectures**
Unit III : Aircraft Certification **(a) General** certification rule: such a FAA and EACS 23/25/27/29; Type certification; Supplemental type certification; CAR – 21 Design/ Production organization approvals. Aircraft modifications and repairs approval and certification permit to fly requirements. **(b) Documents:** Certificate of airworthiness; Certificate of registration; noise certificate; weight schedule; radio station license and approval		**30 Lectures**

Reference Book :

1. CAR by DGCA
2. CAR 66 by DGCA
3. CAR 145 by DGCA
4. CAR 21 by DGCA
5. CAR M by DGCA

Course Code		Credits :3
USARM 203	**DIGITAL TECHNIQUES I**	
Unit I –Numbering Systems : Numbering systems: binary, octal and hexadecimal; Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.		**20 Lectures**
Unit II – Data buses and Data conversions: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications. Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types		**20 Lectures**
Unit III - Logic Circuits and Microprocessors: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit		**30 Lectures**
Reference Book : 1. Digital Principles and Applications by DONALD P. LEACH, ALBERTPAUL ALVINO, GOUTAM SAHA		

Course Code		Credits :4
USARM 204	**MATERIALS AND HARDWARE I**	
Unit I - **Aircraft Materials - Ferrous and Non Ferrous :** Characteristics, properties and identification of common alloy steels and non ferrous alloys used in aircrafts; Heat treatment and application of alloy steels and non ferrous alloys. Testing of alloys steels and non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance. **Wooden structures:** Construction methods of wooden airframe structures. Characteristics properties and types of wood and glue used in aeroplanes, preservation and maintenance of wooden structure; Types of defects in wood material and wooden structures; The detection of defects in wooden structure; Repair of wooden covering.		**30 Lectures**
Unit II -Composite materials : Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents.		**30 Lectures**

The detection of defects/deterioration in composite and non-metallic material. Repair of composite and non-metallic material. Types of corrosion and their identification	
Unit III –Fasteners : **Screw** nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; **Bolt** types: specification, identification and marking of aircraft bolts, international standards; **nuts, studs , Washers.** Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels. **Locking devices:** Tab and spring washers, locking plates, split pins, palnuts, wire locking, quickrelease fasteners, keys, circlips, cotter pins.	**20 Lectures**
Reference Book :- 1. FAA-H-8083-30(9A) & 15 A 2. Shop Theory (Anderson)	

Course Code		Credits :3
USARM 205	**MAINTENANCE PRACTICES AND GROUND HANDLING**	
Unit I –MAINTENANCE PRACTICES : Testing, cleaning and inspection of bearings; Lubrication requirement of bearings. Defect of bearings & their causes. Swaging of end fittings, inspection & testing of control cables Bowden cables, aircraft flexible control systems. Inspection of gears, backlash, Inspection of belts & pulleys, chains & sprockets Inspection of screw jacks, lever devices, push-pull rod systems. Maintenance planning; Modification procedures; Stores procedures; Certification/release procedures; Interface with aircraft operation; Maintenance Inspection/Quality Control/Quality Assurance; Additional maintenance procedures. Control of life limited components.		**20 Lectures**
Unit II – Aircraft Weight and Balance and storage: Centre of Gravity/Balance limits calculation: use of relevant documents; preparation of aircraft for weighing Aircraft weighing Aircraft taxiing/towing and associated safety precautions; Aircraft jacking, chocking, securing and associated safety precautions; Aircraft storage methods; Refueling/defueling procedures; De-icing/anti-icing procedures. Different methods of aircraft leveling		**20 Lectures**
Unit III – Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reprotection. General repair methods, Structural Repair Manual Ageing, fatigue and corrosion control programmes; Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. **Abnormal Events:** Inspections following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.		**20 Lectures**
Reference Book :- **1.** FAA 9A **2.** CAIP volume		

PRACTICALS

Course Code	PRACTICALS	Credits :1
USARM 2P1	**PHYSICS**	50 marks
1. To measure the length, ,breadth and height of rectangular block using vernier caliper 2. To measure the outer and inner diameter of the pipe using vernier caliper 3. To measure the inner and outer radius using radius gage 4. To measure the gap between electrodes of spark plug using thickness gauge 5. To measure the pressure using Manometer 6. To measure specific gravity of given fluid using hydrometer. 7. To measure the inner diameter of the pipe using telescopic gauge 8. To show magnetic lines of forces never intersect each other using bar magnet 9. Show the nature of airflow using venturi tube (Bernoulis theorem) 10. Show Newton's laws of motion 11. Identification of poles, equator, meridian, latitude and longitude with globe		**80 hours**

Course Code	PRACTICALS	Credits :1
USARM 2P2	**DIGITAL TECHNIQUES**	50 marks
1. To Study the working of AND gate 2. To Study the working of OR gate 3. To Study the working of NAND gate 4. To Study the working of NOR gate 5. To Study the working of NOT gate 6. Observe the working of flip flop 7. Clock 8. seven segment decoder circuit 9. Multiplexer IC 10. Demultiplexer IC 11. A-D/D-A converter IC		**80 hours**

Course Code	PRACTICALS	Credits :2
USARM 2P3	**GROUND HANDLING**	100 marks
AIRCRAFT GROUND HANDLING & WEIGHT AND BALANCE:- 1) Cabin door- Upper, lower, opening, closing and locking 1) Carry out weight and balance of aircraft 2) carry out taxing and towing of aircraft 3) Carry out jacking up and lowering of aircraft 4) use Proper procedure for parking of aircraft 5) Carry out refueling of aircraft 6) Carry out defueling of aircraft 7) use ground hydraulic supply 8) carry out Procedure for lashing and mooring of aircraft 10) familiarization with marshalling of aircraft		**80 hours**

INFRASTRUCTURE:

a) The basic Infrastructure required to start the Course in the Organization, at the start of the Course.

Infrastructure: As per University norms.

Basic Workshop: Having Lathe Machine, Drilling machines, Grinders, Surface table, bench vices etc.

Land area: Sufficient land for building a Hanger for parking the Institution owned aircrafts and Tarmac for giving run up and taxy check of those aircrafts.

The Cost of the above infrastructure and Basic Workshop is Rs. 25,00,000/- (approx. as on date) excluding the cost of land.

b) After starting the Course, the Equipments required in the Organization at the start of Second semester

Laboratory / Workshop:

i) Electrical Workshop
ii) Instrument Workshop
iii) Radio Navigation Workshop
iv) Computer Workshop
v) RT (Radio Telephony) – Communication
*vi) Welding Shop. (1 Lakhs)
*viii) Machine Shop (5 Lakhs)

Note: All the shops to be well equipped to carry out practical of the students. The Cost of the above infrastructure is Rs. 80,55,000/- (approx. as on date) + 6 lakhs

c) After starting the Course, the Infrastructure required in the Organization at the start of Third semester i.e. Second year will be as follows:-

i) Hanger and Tarmac: For parking aircrafts, their run-up and taxying for functional checks of the various systems.

ii) Aircrafts: 1) Light aircraft (weight below 5700 kg) & Piston engine
2) Heavy aircraft (weight above 5700 kg) & Jet engine

iii) Workshops: 1) Engine Workshop
2) Airframe Workshop

The Cost of the above is Rs. 2,93,00,000/- (approx. as on date)

Total cost for all three years a) + b) + c) = Rs. 3,98,55,000/- + 6 Lakhs

Faculty Qualifications and requirements:

Chief Instructor : a) One each, having BAMEL (Basic Aircraft Maintenance Engineering Licence) and at least five years of Aviation Experience of which at least two years in the field of Instruction **OR**

b) Engineering Graduate with at least two years of Practical experience in Aviation Industry of which at least one year in the field of Instruction.

Instructors :

Year	New Appointments	Total Appointments
1st year	03	03
2nd year	03	06
3rd year	03	09

Non Teaching

Office staff : 02 Jr. Clerk
Peon : 03

* Additional workshops

External Theory examination 60
Marks

i) Duration – These examinations shall be of 2 Hours duration for each paper.

ii) Theory Question Paper Pattern:-

• There shall be four questions each of 15 marks. On each unit there will be one question and the fourth one will be based on entire syllabus.

• All questions shall be compulsory with internal choice within the questions.

(Each question will be of 20 to 23 marks with options.)

• Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.