

BHARATHIAR UNIVERSITY: COIMBATORE 641046
B.Sc. AIRCRAFT MAINTENANCE
(For the CCII candidates admitted from the academic year 2014-15 onwards)
SCHEME OF EXAMINATION – CBCS Pattern

Part	Subject	Name of the subject	Ins. hrs / week	Examinations				Credits
				Dur.H	CIA	Marks	Total Marks	
First Year - Semester-I								
I	Language – I		6	3	25	75	100	4
II	English-I		6	3	25	75	100	4
III	Core I- Basic aerodynamics		4	3	20	55	75	3
III	Core II- Workshop practices-I		3	3	20	55	75	3
III	Practical-I- Workshop practices-I		2	3	20	30	50	2
III	Allied - Electrical fundamental **		4	3	25	75	100	4
III	Allied Practical- Electrical Fundamental		3	3	40	60	100	4
VI	Environmental Studies #		2	3	-	50	50	2
First Year - Semester-II								
I	Language-II		6	3	25	75	100	4
II	English-II		6	3	25	75	100	4
III	Core III - Air law, Airworthiness Requirements		4	3	25	75	100	4
III	Core IV - Aircraft Materials & Hardware		3	3	25	75	100	4
III	Practical-II - Aircraft Materials & Hardware		3	3	40	60	100	4
III	Allied - Electronic Fundamentals and Digital Techniques		3	3	25	75	100	4
III	Allied Practical-Electronic Fundamentals and Digital Techniques		3	3	40	60	100	4
VI	Value Education - Human Rights #		2	3	-	50	50	2
Second Year - Semester-III								
III	Core V - Jet Engine- I		6	3	25	75	100	4
III	Core VI -Piston engine-I		6	3	25	75	100	4
III	Practical-III - Jet Engine- I		4	3	40	60	100	4
III	Elective-I		4	3	20	55	75	3
III	Practical for Elective-I		4	3	20	30	50	2
VI	Skill Based Subject - I Maintenance Practices-I		4	3	20	55	75	3
VI	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights #		2	3	50		50	2
Second Year - Semester-IV								
III	Core VII - Jet Engine- II		6	3	25	75	100	4
III	Core VIII- Piston engine-II & Propellers		6	3	25	75	100	4
III	Practical-IV - Piston engine-II & Propellers		3	3	20	30	50	2
III	Elective-II		5	3	20	55	75	3
III	Practical for Elective-II		4	3	20	30	50	2
III	Skill Based Subject - II Practical-Maintenance Practices-I		4	3	30	45	75	3
VI	Tamil @ / Advanced Tamil # (or) Non-major elective -II : General Awareness #		2	3	50		50	2
Third Year - Semester-V								
III	Core IX - Jet Engine Maintenance		5	3	25	75	100	4
III	Core X - Piston Engine Maintenance		5	3	25	75	100	4

III	Practical - Jet Engine Maintenance	4	3	40	60	100	4
III	Practical - Piston Engine Maintenance	4	3	40	60	100	4
IV	Skill Based Subject III- Maintenance Practices-II	3	3	20	55	75	3
IV	Skill Based Subject IV- Practical- Maintenance Practices II	3	3	30	45	75	3
III	Elective - III	4	3	20	55	75	3
III	Elective - IV	4	3	20	55	75	3
III	Practical for Electives III	2	3	20	30	50	2
III	Practical for Electives IV	2	3	20	30	50	2
Third Year - Semester-VI							
III	Project work & Viva Voce (ON JOB TRAINING)	-	-	-	-	250^	10
TOTAL						3500	140

LIST OF ELECTIVES

List of Elective papers (Colleges can choose any one of the paper as electives)

SUBJECT	SUBJECT TITLE
Elective -I	Airplane Dynamics and Structure
	Helicopter Dynamics and Flight control
Elective- II	Airplane System
	Helicopter System
Elective -III	Helicopter Maintenance
	Light Aeroplane Maintenance
Elective- IV	Gear box and Rotor Maintenance
	Heavy Aeroplane Maintenance

PROJECT WORK (ON JOB TRAINING)

MARKS - 250

On successful completion of five semesters, the students proceed to their final semester where they will undertake **six months 'On Job Training'** related to aircraft maintenance / airport management /ground handling / cargo management and air traffic movements. They may carry out this project at major scheduled/non-scheduled airlines, maintenance repair organizations (MRO's), aircraft component repair shops, flying clubs, etc.

During this period the students will work on live and airworthy aircraft and aircraft components, thereby gaining professional hands-on experience in their chosen trade. This enables the students to attain the level of competency required for entry into the aviation industry. It also empowers the students to shoulder higher responsibilities within the aviation industry at a younger age.

* For subjects without practical

** For subjects with Practical

^ For Project Report 80% Marks; Viva-Voce 20% Marks

@ No University Examinations. Only Continuous Internal Assessment (CIA)

No Continuous Internal Assessment (CIA). Only University Examinations

CORE- I - BASIC AERODYNAMICS

Objectives

To help students to understand the theoretical concepts underlying the development of lift, drag, and movement forces on aeronautical vehicles.

Unit I

Introduction to Aviation:

History of Aviation, Aeronautical terms and definitions; Atmosphere – Atmosphere layers – composition of Air, Inertia of air, - Effect of temperature and pressure on Density, - Density of air, Pressure of the atmosphere, Decrease of pressure and Density with altitude, Effect of temperature, -humidity and its effect, -International Standard Atmosphere (ISA), application to aerodynamics

Unit II

Aerodynamics

-Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, up wash 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, stall; - Aerofoil contamination including ice, snow, frost.

Unit III

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.

Unit IV

Flight Stability and Dynamics

-Static stability, Dynamic stability, Subsidence and Divergence,- Longitudinal stability, -lateral stability and Directional stability. Factors influence longitudinal stability, -Factors affecting lateral stability, - Factors governing directional stability, - Stability requirements, - roll with yaw

Unit V

Basics for atmospheric radioactivity:

Atoms and radiation- Radiation and matter-Source of ionizing radiation-Natural radiation- Radioactivity in the natural environment –Personnel exposure-Radiation effects – System of radiation protection

Books for Study:

Aircraft Basic science by Kroes & Rardon , TATA Macgraw Hill 7th Edition
Mechanics of Flight by A C Kermode, Published by Dorling kindersley (India) Private Ltd, 11Edition

Reference:

Airframe & Power plant Mechanics (General Handbook EA-AC 65-15A) by Federal Aviation Administration; Shroff publishers, Edition 2012
Aerodynamics-By L J Clancey, Sterling Book House Mumbai, Indian Edition 2006

CORE-II - WORKSHOP PRACTICES – I

Objective

To make the students understand the importance of workshop maintenance practices

Unit-I

Safety Precautions-Aircraft and Workshop

-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.

Unit-II

Tools

-Common hand tool types; Common power tool types; -Lubrication equipment and methods. - Operation, function and use of electrical 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.

Unit-III

Precision Instruments:

Construction, operation and use of precision instruments: - Micrometers of various types - internal micrometer external micro meter, depth micrometer, tube micrometer; - purpose usage and calibration and error correction: - Vernier calipers – purpose, usage and calibration, - Vernier bevel protractor, Dial gauge, optical flat, slip gauge –usages.

Unit-IV

Fits and Clearances

-Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; -Schedule of fits and clearances for aircraft and engines; -Limits for bow, twist and wear; -Standard methods for checking shafts, bearings and other parts.

Unit-V

Welding, Brazing, Soldering and Bonding

Methods of joining materials, Welding, Soldering, Brazing and Bonding, - Types and equipments used -types of welded joints, types of flames. – Gas welding procedure and technique, -welding faults, - Inspection of welded and brazed joints; - inspection of bonded joints.

Book for Study:

Shop Theory by James Anderson Earl E. Tatro, McGraw Hill, 6th edition
Aircraft General engineering –by Lalit Gupta- Himalayan Book presentation -2008

Reference:

1. Airframe & Powerplant Mechanics (General Handbook EA-AC 65-9A) –by Federal Aviation Administration; Shroff publishers, Edition 2012
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

ALLIED - ELECTRICAL FUNDAMENTALS

Objective

To make the students understand the principle and concept of Aircraft electricity

Unit-I

Generation of Electricity

-Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators - 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.
-The following terms, their units and factor affecting them: potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow.
-Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

Unit-II

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, Kirchhoff's Voltage and Current Laws; calculations using the above laws to find resistance, voltage and current; significance of the internal resistance of a supply.

Unit—III

-Resistance/ Resistor

-Resistance and affecting factors; specific resistance; Resistor colour code, Values and tolerance, preferred values, wattage ratings; Resistors in series and parallel; -Calculation of total resistance using series, parallel and series parallel combination; -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 of potentiometers and rheostats; Construction of Wheatstone Bridge;

Unit-IV

Power: -Power, Work and energy (kinetic and potential); -Dissipation of power by a resistor, Power formula; -Calculations involving power, work and energy.

Unit-V

Capacitance/ Capacitor

-Operation and function of a capacitor; Factor 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; Calculation of capacitance and voltage in series and parallel circuits; -Exponential charge and discharge of capacitor, time constant; -Testing of capacitor.

Book for Study:

1. Aircraft Electricity and Electronics by Thomas Eismin, Macgraw Hill Publication 6th Edition
2. Aircraft mechanics Hand Book – Airframe by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

Reference:

1. Electrical Technology-by B.L.Theraja Publisher- Chand, New Delhi, 6th edition
2. Aircraft Electrical System-by E.H.J.Pallett, Publisher –Dorling Kindersley 3rd edition

SEMESTER – II**CORE III - AIR LAW, AIRWORTHINESS REQUIREMENTS****Objective**

To make the students understand and familiarize with the air law and airworthiness requirements

Unit-I

-Aircraft manual (India) - Aircraft Act 1934- Aircraft Rules 1937, -Various circulars and orders issued by DGCA- Airworthiness Advisory Circulars -Aeronautical Information Circulars-ITSO.
-CAR Section-2 Series A- Part III; CAR Section-2 Series B- Part I & II; Car Section-2 Series C- Part I, II, III &IV; Car Section-2 Series D- Part I to IX; Car Section-2 Series F- Part I to XXII

Unit-II

2-CAR series H - Part I; CAR series I - Part I to VIII; CAR 66 and GM to section A of CAR 66;
-CAR series L Part I to XI; CAR series M; CAR series O - Part I to XIV; -CAR series R - Part I to VI; -CAR series S - Part I & II; -CAR series T - Part I & II; -CAR series X - Part II to VIII

Unit-III

-CAR 145- Approval of Maintenance Organisations – Facility requirements- Personal requirements- Certifying and support staff – Equipments ,tools, and material-Acceptance of components –Maintenance data- Production planning-C of M- Occurrence reporting-Safety and quality policy.
-Maintenance Organisation Exposition Privileges, limitations and changes to the Organisation - Use of CA form 1 for maintenance-Organisation approval class and rating system-Various forms –Fuel tank safety training

Unit-IV

-CAR M – General – Accountability- Continuing airworthiness -Maintenance standards – Components-Maintenance organisation - Continuing airworthiness management organisation CRS- Airworthiness review certificate.
Acceptable means of compliance to CAR M – Continuing airworthiness -Maintenance standards – Components-Maintenance organisation - Continuing airworthiness management organisation - CRS Airworthiness review certificate. -CAR M - Section B – Procedure for DGCA

Unit- V

-CAR 21- Sub part A- General - Sub part B -Type certificates and Restricted Type certificates- Sub part D- Changes to Type certificates and Restricted Type certificates - Sub part E - Supplemental Type Certificates- Sub part F- Production without production organization approval - Sub part G- Production organization approval - Sub part H - C of A, restricted C of A and Export C of A- Sub part I – Noise certificates.

-CAR 21- Sub part JA - Design organization approval- Sub part JB- Parts and appliances- Sub part K - Parts and appliances - Sub part M- Repairs - Sub part O- Indian Technical Standard order authorizations- Sub part P -Permit to fly- Sub part Q - Identification of projects, Parts, and appliances .

Book for Study:

1. Aircraft Manual by DGCA, Sterling book House Mumbai – Up Dated & Latest Edition
2. Civil Aviation Requirements (Section 2- Airworthiness) - by DGCA, Sterling book House Mumbai – Up Dated & Latest Edition
3. Aeronautical Information Circulars (relating to Airworthiness) - by DGCA, Sterling book House Mumbai – Up Dated & Latest Edition
4. Airworthiness Advisory Circulars- by DGCA, Sterling book House Mumbai – Up Dated & Latest Edition

Reference:

www.dgca.nic.in

CORE-IV - AIRCRAFT MATERIALS AND HARDWARE**Objective**

To make the students understand and familiarize with the aircraft materials and hardware

Unit-I**Aircraft Materials**

-Characteristics, properties and identification of common alloy steels used in aircraft; -Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.
 -Characteristics, properties and identification of common non-ferrous materials used in aircraft;
 -Wood 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 structure. Fabric covering:
 -Characteristics, properties and types of fabrics used in aeroplanes; -Inspections methods for fabric; Types of defects in fabric; Repair of fabric covering

Unit-II**Corrosion:**

-Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;

- Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Unit-III

Fasteners, locking devices, pipes and Unions, springs, bearings:

-Screw threads, Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; Measuring screw threads. -Tab and spring washers, locking plates, split pins, pal-nuts, wire locking; quick release fasteners, keys, circlips, cotter pins. -Aircraft rivets - Types of solid and blind rivets: specifications and identification, heat treatment. Identification of, and types of rigid and flexible pipes and their connectors used in aircraft; -standard unions for aircraft hydraulic, fuel, oil pneumatic and air system pipes. -Types of springs, material, characteristics and applications. -Purpose of bearings, load, material, construction; Types of bearings and their application.

Unit-IV

Transmissions, control cables, electrical Cable and Connectors

-Gear types and their application; Gear ratios; reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets -Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; -Aircraft flexible control systems. -Cable types, construction and characteristics; High tension and co-axial cables; Crimping; Connector types, pins, plugs, sockets, insulators, current and voltage rating, coupling, identification codes.

Unit-V

Aircraft Materials-Composite and Non-Metallic

-Composite and non-metallic materials, other than wood and fabric; -Characteristics, properties and identification of common composite and non-metallic materials, other wood, used in aircraft; Sealant and bonding agents. -The detection of defects/ deterioration in composite and non-metallic material. -Repair of composite and non-metallic material.

Books for Study

1. Airframe & Power plant Mechanics (General Handbook EA-AC 65-9A) By FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006
3. Aircraft Materials & Processes by Titterton – Sterling Book House 5th Edition

Reference Books:

1. Advanced Composites (EA-358) by Cindy Foreman 1990 Edition, Publisher - Jeppesen Sanderson
2. Aircraft General Engineering by Lalit Gupta, Publisher: Himalayan Books, New Delhi 6th reprint -2010

ALLIED - ELECTRONIC FUNDAMENTALS AND DIGITAL TECHNIQUES

Objective

To make the students understand the principle and concept of electronic fundamentals and digital techniques

Unit-I

Transistors: -Transistors 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 stabilization; -Multistage circuit principles: cascades, push pull, oscillators, multi vibrators, flip-flop circuits.

Unit-II

Integrated Circuits: -Description and operation of logic circuits and linear circuits/operational amplifiers. 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.

Unit-III

Servo mechanics: -Understanding of the following terms; -Open and closed loop systems, feedback, follow up, analogue transducer; -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 thee 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.

Unit-IV

Numbering systems: - binary, octal and hexadecimal; -Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.
- Operation of data buses in aircraft systems, including knowledge of ARINC and -other specification Identification of common logic gate symbols, tables and equivalent circuits; - Application used for aircraft systems, schematic diagrams. -Interpretation of logic diagrams.

Unit-V

Basic Computer Structure: -Computer terminology (including bit, byte, software, CPU, IC, and various memory devices such as RAM, ROM, PROM); Computer technology (as applied in aircraft systems). -Computer related terminology; Operation, layout and interface of the major

components in a micro computer including their associated terms; -Operation of typical memory devices; -Operation, advantages and disadvantages of the various data storage systems.

Book for Study:

Digital Fundamentals by Malvino and Leach, 4th Edition : Tata McGraw-Hill
Electrical Technology-by B.L.Theraja Publisher- Chand, New Delhi, 6th edition

Reference:

Aircraft Electrical System-by E.H.J.Pallett, Publisher –Dorling Kindersley 3rd edition
Basic Electronics- by Bemard Grob, Published by TATA McGraw-Hill, 7th Edition
Digital Computer Fundamentals-by Malvino, TATA McGraw-Hill, 3rd Edition

SEMESTER –III

CORE V - JET ENGINE-I

Objective:

To make the students understand the principle, construction and operation of Jet Engine

Unit-I

-Fundamentals: Potential energy, kinetic energy, Newton’s laws of motion, Brayton cycle; -The relationship between force, work, power, energy, velocity, acceleration; -Constructional arrangement and operation of turbojet, turbofan, turbo shaft, turboprop -Gross thrust, net thrust, choked nozzle thrust distribution, resultant thrust, thrust horsepower; equivalent shaft horsepower, specific fuel consumption; Engine efficiencies; -By-pass ratio and engine pressure ratio; Pressure, temperature and velocity of the gas flow; -Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.

Unit-II

-Inlet: Compressors inlet ducts Effects of various inlet configurations; Ice protection.
-Compressors: Axial and centrifugal types; -Constructional features and operating principles and applications; Fan balancing; -Operation: Causes and effects of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ratio. -Combustion Section: Constructional features and principles of operation, -Turbine Section: Operation and characteristics of different turbine blade types. -Blade to disk attachment; Nozzle guide vanes; Causes and effects of turbine blade stress and creep.

Unit-III

-Exhaust: Constructional features and principles of operation; -Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers

Unit-IV

-Bearings and seals: Constructional features and principles of operation; -Lubricants and fuels:
-Properties and specifications; Fuel additives; safety precautions.
-Lubrication Systems: System operation/ lay-out and components

Unit-V

-Fuel Systems: Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components

Study books:

1. A/P Technician hand book Power plant by Jeppesen, Jeppesen Sanders 2004 edition
2. Aircraft mechanics Hand Book - Power Plant Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

Reference:

1. IRWINE TREAGER: Aircraft Gas Turbine Technology McGraw-Hill Book Company. 2013
2. ROLLS ROYCE LIMITED: The Jet Engine' Product Support (Graphics) Limited Derby, England.
3. M.J.KROES, T.W.Wild, McGraw-Hill Education 2014

CORE - VI - PISTON ENGINE-I**Objective:**

To make the students understand the principle, construction and operation of Piston Engine

Unit-I**Fundamentals**

-Mechanical, thermal and volumetric efficiencies; Operating principles - 2 stroke, 4 stroke, Otto and Diesel; -Piston displacement and compression ratio; -Engine configuration and firing order.

Unit-II**Engine Performance & Construction**

- Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition, -Engine Construction: Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; -Propeller reduction gearboxes

Unit-III**Engine Fuel Systems**

- Carburetor types, construction and principles of operation; Icing and heating. -Fuel injection systems Types, construction and principles of operation. - Electronic engine control Operation of engine control and fuel metering systems including electronic engine control (FADEC);

Unit-IV**Systems lay-out and components.**

-Starting systems, pre-heat systems; -Magneto types, construction and principles of operation; - Ignition harnesses, spark plugs; -Low and high tension systems. -Induction, Exhaust and Cooling Systems, -Construction and operation of: induction systems including alternate air systems; Exhaust systems, engine cooling systems - air and liquid. -Supercharging / Turbo charging

Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of super charging of turbo charging systems; System terminology; Control systems; System protection.

Unit-V

Lubricants and Fuels

-Properties and specifications; -Fuel additives; Safety precautions. -Lubrication system operation/lay-out and components

Study books:

1. A/P Technician hand book Power plant by Jeppesen, Jeppesen Sanders 2004 edition
2. Aircraft mechanics Hand Book - Power Plant Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

Reference:

1. Aircraft Piston Engines-By Herschel Smith, Sterling Book house, Mumbai 1986 edition
2. Aircraft Propeller and Controls-by Frank Delp, Publishers: Aviation Maintenance Pub 1979

SKILL BASED SUBJECT- I - MAINTENANCE PRACTICES – I

Objective:

To make the students understand and familiarize with the Maintenance practices-II

Unit-I

Riveting

-Riveted joints, rivet spacing and pitch; -Tools used for riveting and dimpling; -Inspection of riveted joints. - Overlap and insertion patch repairs, calculation of rivets requirements, - Blind/ tubular riveting tools and procedure

Unit-II

Pipes and Hoses

- Bending and belling/ flaring aircraft pipes; -Inspection of aircraft pipes and hoses; -Installation and clamping of pipes. --Repair of rigid pipelines, bending and forming. -Testing of rigid pipelines – flow and pressure testing.

Unit-III

Springs

-Purpose, material used for manufacturing, - Types, -their application, -Installation and removal procedure, Inspection and testing of springs. – Corrosion prevention methods

Unit-IV

Bearings

-Testing, cleaning and inspection of bearings; -Lubrication requirements of bearing; -Defects in bearings and their causes.-Installation and removal. --Storage/preservation

Unit-V**Control Cables**

-Swaging of end fittings; -Inspection and testing of control cables; -Bowden cables; - aircraft flexible control systems. -Proof loading of formed cable, -turn buckle safe tying method.

Book for Study:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012
2. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
3. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Aircraft Maintenance and Repair – Michael J. Kroes, William A Watkins, TATA McGraw Hill, 2012 Edition

SEMESTER –IV**CORE-VII - JET ENGINE-II****Objective:**

To make the students understand the principle, construction and operation of Jet Engine and its system

Unit-I**Systems:**

- Air systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services; -Starting and ignition Systems: Operation of engine start systems and components; Ignition systems and components; -Maintenance safety requirements; -Engine Indication Systems: Exhaust Gas Temperature/ Inter-stage Turbine Temperature; -Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; -Oil pressure and temperature; Fuel pressure and flow; Engine speed; -Vibration measurement and indication; Torque; Power. -Power Augmentation Systems: Operation and applications; Water injection, water methanol; Afterburner systems

Unit-II**Engines**

- Turbo-prop Engines: Gas coupled/free turbine and gear coupled turbines; Reduction gears; Integrated engine and propeller controls; Over speed safety devices
-Turbo- shaft engines: Arrangements drive systems, reduction gearing, couplings, control systems.
-Auxiliary Power Units (APUs): Purpose, operation, protective systems

Unit-III**Power plant Installation**

- Configuration of firewalls, cowlings, acoustic panels, and engine mounts; -anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains

Unit-IV**Fire Protection Systems**

-Fire /Over heat detection and extinguishing system for Gas turbine engines; - single wire thermal switch, Two wire thermal switch, - Continuous loop system, -Pneumatic system,- other fire detection system. Fire extinguishing methods, -Cleaning of the engine after use of the extinguishing agents.

Unit-V**Engine Monitoring, ground Operation, storage and preservation**

- Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boro-scope) Monitoring; - Inspection of engine and components to criteria, tolerance and data specified by engine manufacturer; - Compressor washing/ cleaning; Foreign Object Damage. -Preservation and de-preservation for the engine and accessories/ systems.

Study books:

1. IRWINE TREAGER: Aircraft Gas Turbine Technology McGraw-Hill Book Company. 2013
2. A/P Technician hand book Power plant by Jeppesen, Jeppesen Sanders 2004 edition
3. Aircraft mechanics Hand Book - Power Plant Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

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2. ROLLS ROYCE LIMITED: The Jet Engine' Product Support (Graphics) Limited Derby, England.
3. M.J.KROES, T.W.Wild, McGraw-Hill Education 2014

CORE-VIII - PISTON ENGINE-II & PROPELLERS**Objective:**

To make the students understand the principle, construction and operation of Piston Engine and Propellers

Unit-I**Fundamentals**

-Blade element theory; High/ low blade angle, angle of attack, rotational speed; -Propeller slip; Aerodynamic, centrifugal, and thrust forces torque; -Relative airflow on blade angle of attack; Vibration and resonance.

Unit-II**Propeller Construction**

-Construction: Construction methods and materials used in wooden, composite and metal propellers; -Blade station, blade face, blade shank, blade back and hub assembly; -Fixed pitch, controllable pitch, constant speed propeller; -propeller/spinner installation.

Unit-III**Propeller Pitch Control**

Speed control and pitch change methods, mechanical and electrical/ electronic; - Feathering and reverse pitch; -Over speed protection; -Propeller Synchronizing: -Synchronizing and synchrophasing equipments; -Propeller Ice Protection: Fluid and electrical de-icing equipment. - Propeller Maintenance: Static and dynamic Balancing; Blade Tracking; -Assessment of blade damage, erosion, corrosion, impact damage, de-lamination; Propeller treatment/ repair schemes; Propeller engine running. -Propeller Storage and Preservation: Propeller Preservation and de-preservation

Unit-IV**Power Plant Installation & Engine monitoring and Ground Operation**

-Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains. -Procedures for starting and ground run-up; -Interpretation of engine power output and parameters; -Inspection of engine and components; -criteria, tolerance, and data specified by engine manufacturer.

Unit-V**Engine Storage and Preservation**

-Preservation and de-preservation for the engine and accessories/ systems.

Study books:

1. A/P Technician hand book Power plant by Jeppesen, Jeppesen Sanders 2004 edition
2. Aircraft mechanics Hand Book - Power Plant Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

Reference:

1. Aircraft Piston Engines-By Herschel Smith, Sterling Book house, Mumbai 1986 edition
2. Aircraft Propeller and Controls-by Frank Delp, Publishers: Aviation Maintenance Pub 1979

SEMESTER-V

CORE-IX - JET ENGINE MAINTENANCE

Objective:

To make the students understand and familiarize with Jet Engine Maintenance

Unit-I

-Inspection & maintenance of lubrication system: - Adjustment of oil pressure, oil filters maintenance, - contamination and sampling. Fuel system: -Fuel handling and safety precautions, fuel additives and water detection, -inspection and maintenance of fuel components, - trouble shooting fuel system

Unit-II

-Inspection & maintenance of ignition system: Inspection and repair of ignition system, - Cleaning inspection and changing of LT & HT igniter plugs. Starting system: -inspection of starting system trouble shooting of starter and starter generator, -starting system maintenance practice.

Unit-III

-Inspection & maintenance of thrust reverser; -Operation of thrust reverser, different types, - thrust reverser door, links and cascade vanes, - inspection of thrust reverser system. Fire protection system, - inspection of fire detection and extinguishing system, trouble shooting

Unit-IV

-Inspection before engine run-up, -trimming and trimming restrictions, -engine stopping and precautions checking the performance of the engine and its components, -Throttle spring and cushion checks. Inspection with cold & hot section of a GTE

Unit-V

- Safety precautions for engine removal and installation; -Removal procedure of a turbojet engine; -Installation procedure of a turbojet engine, -engine preservation & de-preservation -Precaution & procedure of ground run of engine

Book for Study:

1. IRWINE TREAGER: Aircraft Gas Turbine Technology McGraw-Hill Book Company. 2013
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. M.J.Kroes, T.W.Wild, R.D.Bent and J.L.McKinley; 'Aircraft Power Plants' McGraw-Hill Education 2014
2. Aircraft Propeller and Controls-by Frank Delp, Publishers: Aviation Maintenance Pub 1979

CORE-X - PISTON ENGINE MAINTENANCE

Objective:

To make the students understand and familiarize with Piston Engine Maintenance

Unit-I

-Inspection & maintenance of lubrication system: - Adjustment of oil pressure, oil filters maintenance. Fuel system: -Fuel handling and safety precautions, fuel additives and water detection, -inspection and maintenance of fuel components, - trouble shooting fuel system

Unit-II

-Inspection & maintenance of ignition system: Inspection and servicing of spark plug - Cleaning inspection and changing, -magneto maintenance and inspection. Starting system: -Direct cranking and electrical starting system inspection and maintenance. Trouble shooting procedure

Unit-III

-Cylinder compression testing procedure; - Occasions of cylinder compression testing, - direct compression testing, -Differential pressure compression testing, engine run-up, - inspection during & before engine run-up

Unit-IV

- Reason for removal of engine, preparation for engine removal, engine removal procedure, inspection to be carried out on engine mountings and installations, - preparation for engine installation, -engine installation procedure of a piston engine; Engine preservation & de-preservation

Unit-V

-Top overhaul of piston engine. -Precautions& procedures adopted during ground run

Book for Study:

1. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006
2. A/P Technician hand book Power plant by Jeppesen, Jeppesen Sanders 2004 edition
3. Aircraft mechanics Hand Book - Power Plant Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

Reference:

1. M.J.Kroes, T.W.Wild, R.D.Bent and J.L.McKinley; 'Aircraft Power Plants' McGraw-Hill Education 2014
2. Aircraft Propeller and Controls-by Frank Delp, Publishers: Aviation Maintenance Pub 1979

SKILL BASED SUBJECT III - MAINTENANCE PRACTICE-II**Objective:**

To make the students understand and familiarize with Maintenance Practice-II

Unit-I**Material Handling**

- Sheet Metal marking out and calculation of bend allowance; - Sheet metal working including bending and forming; Inspection of sheet metal work. - Composite and non-metallic Bonding practices; - Environmental conditions, Inspection methods

Unit-II Welding, Brazing, Soldering and Bonding

- Soldering methods; inspection of soldered joints
- Welding and brazing methods; - Inspection of welded and brazed joints; - Bonding methods and inspection of bonded joints.

Unit-III Aircraft Weight & Balance, handling and Storage

- Centre of Gravity/ Balance limits calculation: use of relevant documents; -Preparation of aircraft for weighing; -Aircraft taxiing/towing and associated safety precautions; -Aircraft jacking, chocking, securing and associated safety precautions; -Aircraft storage methods; -Refuelling/ defueling procedures; -De-icing/ anti-icing procedures; -Electrical, hydraulic and pneumatic ground supplies. -Effects of environmental conditions on aircraft handling and operation.

Unit-IV Disassembly, Inspection, Repair, Assembly Techniques and Abnormal Events

-Types of defects and visual inspection techniques Corrosion removal, assessment and reproduction. -General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes; -Non destructive inspection techniques including, penetrate, radiographic, eddy current, ultrasonic and boroscopic methods. -Disassembly and re-assembly techniques. - Trouble shooting techniques; -Inspections following lightning strikes and HIRF penetration. - Inspections following abnormal events such as heavy landings and flight through turbulence.

Unit-V Maintenance Procedures:

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

Book for Study:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012
2. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
3. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Aircraft Maintenance and Repair – Michael J. Kroes, William A Watkins, TATA McGraw Hill, 2012 Edition

ELECTIVE-I - AIRPLANE DYNAMICS AND STRUCTURE

Objective:

To make the students understand the principle, concept of airplane dynamics and construction of structure.

Unit-I

Theory of Flight

-Aero-plane Aerodynamics and Flight Controls Operation and effect of; roll control: ailerons and spoilers; pitch control: elevators, Stabilators, variable incidence stabilizers and canards; yaw control, rudder limiters; Control using elevons, ruddervators; - High lift devices, slots, slats, flaps, flaperons; - Drag inducing devices, spoilers, lift dumpers, speed brakes; - Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; -Operation and effect of trim tabs, - balance and anti-balance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;

Unit-II

High Speed Flight

-Speed of sound, subsonic flight, transonic flight, supersonic flight, -Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; -Factors affecting airflow in engine intakes of high speed aircraft; -Effects of sweepback on critical Mach number

Unit-III

Airframe Structures- General Concepts

-Airworthiness requirements for structural strength; - Structural classification, primary, secondary and tertiary; - Fail safe, safe life, damage tolerance concepts; - Zonal and station identification systems; - stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; - Drains and ventilation provisions; - System installation provisions; Lightning strike protection provision Aircraft bonding

Unit-IV

Construction methods

-Stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments; -Structure assembly techniques: riveting, bolting, bonding; - Methods of surface protection, such as chromating, anodizing, painting; Surface cleaning. - Airframe symmetry: methods of alignment and symmetry checks.

Unit-V

Airframe Structures- Aero planes

-Fuselage (ATA 52/53/56): Construction and pressurization sealing; wing, stabilizer, pylon and undercarriage attachments; seat installation and cargo loading system; -Doors and emergency exits: construction, mechanisms, operation and safety devices; window and windscreen construction and mechanisms.

- Wings (ATA 57): Construction; Fuel storage; Landing gear, pylon, control surface and high lift/ drag attachments.

- Stabilizers (ATA 55): Construction; Control Surface attachment.

- Flight Control Surfaces (ATA 55/57): Construction and attachment; Balancing- mass and aerodynamic.
- Nacelles/Pylons (ATA 54); Construction; firewalls; Engine mounts

Book for Study:

1. Aircraft Construction Repair and Inspection by Joe Christy, 2004, Sterling Book House
2. Aircraft Maintenance and Repair Michael J Kroes 2014, Sterling Book House
3. A&P Technician Airframe Text Book, Jeppesen, 2008, Sterling Book House

Reference:

1. Advanced composites Cindy Foreman, 2002 Sterling Book House
2. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

ELECTIVE-I - HELICOPTER DYNAMICS & FLIGHT CONTROL**Objective:**

To make the students understand the principle, concept of helicopter dynamics, construction of structure and flight control

Unit-I**THEORY OF FLIGHT ROTARY WING AERODYNAMICS**

- Terminology, Effects of gyroscopic precession, Torque reaction & directional control, -Dissymmetry of lift, blade tip stall, -Translating tendency and its correction, -Coriolis effect and compensation, -Vortex ring state, power setting, over pitching, -Auto rotation, Ground effect

Unit-II**FLIGHT CONTROL SYSTEM**

- Cyclic control, collective control, swash plate, -Yaw control, -anti torque control, tail rotor, bleed air
- Main rotor head-design and operation features; -Blade dampers-function, construction;

Unit-III**Rotor blades**

- Main rotor blade construction; tail rotor blade construction & attachment; -Tail control, fixed and adjustable stabilizers; - System operation, manual, hydraulic, electrical& fly by wire, artificial feel. - Balancing & rigging

Unit-IV**BLADE TRACKING AND VIBRATION ANALYSIS**

- Rotor alignment; -Main and tail rotor tracking; -Static & dynamic balancing; -Vibration types, vibration reduction method; -Ground resonance

Unit-V**TRANSMISSION**

- Gear boxes, main rotor; - and tail rotors Clutches, - free wheel unit & rotor brake

Book for Study:

1. Aircraft Maintenance and Repair Michael J Kroes 2014, Sterling Book House
2. Helicopter Flying hand book, FAA, 2012 Sterling Book h

Reference:

1. The helicopter Maintenance, Jeppesen, 2007, Sterling Book house
2. Helicopter Aerodynamics-by R.W.Prouty, 2007, Sterling Book house
3. Rotor Craft flying hand book, FAA, 2006, Sterling book house

ELECTIVE-II - AIRPLANE SYSTEMS**Objective:**

To make the students understand the principle, construction and operation of Airplane systems

Unit-I**Air Conditioning and Cabin Pressurization (ATA 21)**

- Air supply-Sources of air supply including engine bleed, APU and ground cart;
- Air Conditioning: Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.
- Pressurization: Pressurization systems; Control and indication including control and safety valves; - Cabin pressure controllers; -Safety and warning devices Protection and warning devices

Unit-II**Equipment and Furnishings (ATA 25)**

- Emergency equipment requirements; Seats, harnesses and belts.
- Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Air stairs.

Unit-III**Fire Protection (ATA 26)**

- Fire and smoke detection and warning systems; -Fire extinguishing systems; Fire extinguishing systems; operation, components installed, - system layout and operation -System test
- Portable fire extinguisher

Unit-IV**Flight Controls (ATA 27)**

- Primary controls: aileron, elevator, rudder, spoiler; -Trim control; Active load control; -High lift devices; Lift dump, speed brakes; - System operation: manual, hydraulic, pneumatic, electrical, fly-by-wire; -Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks systems; -Balancing and rigging; stall protection/warning system.

Unit-V**Fuel Systems (ATA 28)**

- System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refueling and defueling; Longitudinal balance fuel systems.

Book for Study:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA–by Federal Aviation Administration; Shroff publishers, Edition 2012
2. Aircraft Maintenance and Repair Michael J Kroes 2014, Sterling Book House

Reference:

1. A&P Technician Airframe Text Book, Jeppesen, 2008, Sterling Book House
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

ELECTIVE-II - HELICOPTER SYSTEM**Objective:**

To make the students understand the principle, construction and operation of Helicopter systems

Unit-I**Fire protection (ATA 26)**

-Fire and smoke detection and warning systems; -Fire extinguishing systems; operation, components installed, - system layout and operation -System tests, -- Portable fire extinguishers

Unit-II**Fuel systems (ATA 28)**

-System layout; fuel tanks, -Supply systems, Dumping, venting and draining; -Cross-feed and transfer; -Indications and warnings; -Refueling & defueling

Unit-III**Hydraulic Power (ATA 29)**

- System layout, hydraulic fluids; -Hydraulic reservoirs and accumulators; -Pressure generation: electric, mechanical, pneumatic ; -Emergency pressure generation; -Pressure control, power distribution; - Indication and warning systems, interface with other systems-

Unit-IV**Ice and rain protection; Pneumatic /Vacuum (ATA 30 & 36)**

-Ice formation: classification and detection; -Anti-icing and de-icing systems: electrical, hot air and chemical; -Rain repellent and removal; -Probe and drain heating.
- Pneumatic/ Vacuum: System layout - Source: engine, compressors, reservoirs, ground supply
Pressure control and distribution; - Indication and warning systems, interface with other systems-

Unit-V**Landing gear (ATA 32)**

- Construction, Shock absorbing; -Extension and retraction systems: Normal and emergency
- Indication and warning; -Wheels, tires, brakes; -Steering, Skids, floats-

Book for Study:

1. A&P Technician Airframe Text Book, Jeppesen, 2008, Sterling Book House
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

ELECTIVE-III – LIGHT AEROPLANE MAINTENANCE

Objective:

To make the students understand and familiarize with Light Aeroplane Maintenance

Unit-I

Primary, secondary & auxiliary control system inspection and maintenance, - control surfaces removal, inspection and fitment, -control surface balancing, duplicate inspection. – Maintenance and Inspection of aircraft structure by visual inspection and NDT techniques & their repair procedure.

Unit-II

Precautions to be observed while carrying out maintenance on air-conditioning system, - servicing of air-conditioning system components, -Inspection & maintenance of air conditioning system; -trouble shooting procedure. –Hydraulic system, inspection, servicing and maintenance of their components, - Draining, flushing, filling and sampling. – Inspection, servicing and maintenance of Ice & rain protection system & its components

Unit-III

Inspection & maintenance of landing gears, shock strut filling and charging & its components servicing of wheels, tyre, mounting de-mounting ; Brake system removal, servicing, fitment and bleeding procedure .

Unit-IV

Fire protection system, - inspection of fire detection and extinguishing system, trouble shooting Inspection & servicing of portable fire bottles, smoke detection system

Unit-V

Inspection & maintenance of fuel system pipe lines, hoses, and their components, - flexible fuel tank servicing and testing, - rigid fuel tank testing and inspections, - integral fuel tank inspection and servicing & its components

Book for Study

1. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012
2. Light Aircraft maintenance by Jetley wood, year 2000 – Himalayan Books

ELECTIVE-III - HELICOPTER MAINTENANCE

Objective:

To make the students understand and familiarize with Helicopter Maintenance

Unit-I

-Introduction to scheduled maintenance and inspection-calibration of tools, lubrication, Refuelling & defueling. - Ground handling, wheels, skid type and float type landing gear, - servicing of reservoirs and accumulators.

Unit-II

-Moving helicopter on ground handling wheels, main rotor blade tie down, parking. -Ground handling – jacking, hoisting, levelling; -weighing and CG calculation, helicopter weighing procedure, ballast installation, storage of H/C

Unit-III

Pneumatic system inspection and servicing, - Cabin ventilation system servicing, - cabin heating system inspection and servicing, -Hydraulic system servicing, - Filter replacement, draining and flushing of hydraulic system & bleeding and troubleshooting techniques.

Unit-IV

Helicopter structure inspection, -inspection by visual, and -inspection by NDT, -Fastening & torque requirement: general and special; familiarization of materials required, part interchangeable, replacement of components etc.

Unit-V

-Pre flight inspection of engine, cooling and heating system inspection, - Preparation for engine removal, inspection and servicing after engine removal, engine installation procedure. Ground running of helicopter after installation.

Book for Study

1. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Helicopter Maintenance by Joe Schafer, year 2007 Sterling Book House
2. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

ELECTIVE-IV - GEAR BOX AND ROTOR MAINTENANCE

Objective:

To make the students understand and familiarize with Gear Box and Rotor Maintenance Practices

Unit-I

-Introduction to -transmission system, -transmission system components, -Main gear box safety precautions while carrying out maintenance, - main gear box chip and overheat detection system inspection, and servicing, -tail gear box and their transmission system inspection and maintenance.

Unit-II

-Main rotor head & blade: - types, components their Inspection and maintenance, - safety precautions while servicing main rotor and tail rotor, - removal fitment and storage of main and tail rotor blades, - carrying out balancing and tracking

Unit-III

Inspection and servicing of swash plate assembly, -Vibration on helicopter: - main rotor head and tail rotor - types, Static & dynamic balancing analysis and rectification. –Dampers removal servicing and installation.

Unit-IV

-Helicopter control collective and cyclic pitch control system; - Tail rotor control system; - Inspection and their maintenance, - mixing unit removal, servicing and fitment. - Trouble shooting techniques.

Unit-V

- Inspection and maintenance Trim control and stabilizer, stabilizer removal and fitment, - permissible repairs to be carried out on stabilizer,

Book for Study

1. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Helicopter Maintenance by Joe Schafer, year 2007 Sterling Book House
2. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012

ELECTIVE-IV - HEAVY AERO PLANE MAINTENANCE

Objective:

To make the students understand and familiarize with Heavy Aero plane Maintenance

Unit-I

Primary, secondary & auxiliary control system inspection and maintenance, - control surfaces removal, inspection and fitment, -control surface balancing, duplicate inspection. - Maintenance and Inspection of aircraft structure by visual inspection and NDT techniques & their repair procedure

Unit-II

Precautions to be observed while carrying out maintenance on air-conditioning system, - servicing of air-conditioning system components, -Inspection & maintenance of air conditioning system; -trouble shooting procedure. -Hydraulic system, inspection, servicing and maintenance of their components, - Draining, flushing, filling and sampling. - Inspection, servicing and maintenance of Ice & rain protection system & its components

Unit-III

Inspection & maintenance of landing gears, shock strut filling and charging & its components servicing of wheels, tyre, mounting de-mounting ; Brake system removal, servicing, fitment and bleeding procedure .

Unit-IV

Fire protection system, - inspection of fire detection and extinguishing system, trouble shooting Inspection & servicing of portable fire bottles, smoke detection system

Unit-V

Inspection & maintenance of fuel system pipe lines, hoses, and their components, - flexible fuel tank servicing and testing, - rigid fuel tank testing and inspections, - integral fuel tank inspection and servicing & its components

Book for Study

1. AC 43.13-1B - Acceptable Methods, Techniques, and Practices Sterling book House Mumbai Edition 2006
2. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic) by CAA UK, Sterling book House Mumbai Edition 2006

Reference:

1. Aircraft mechanics Hand Book – Airframe Volume 1 &2 by FAA– by Federal Aviation Administration; Shroff publishers, Edition 2012
2. A&P Technician Airframe Text Book, Jeppesen, 2008, Sterling Book House

LIST OF PRACTICALS

WORKSHOP PRACTICE – I

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

FITTING SHOP

1. Cutting of metals and hack sawing practice
2. Demonstration of vernier caliper, parts identification and Practice of vernier caliper Reading.
3. Demonstration of micro meter, parts identification and Practice of micro meter Reading.
4. Making job as per dimensions
5. Making Fitting Job as per dimensions
6. Internal thread cutting using taps
7. External thread cutting using dies
8. Practicing angular measurement using precision tools
9. Demonstration and use of dial test indicator

MACHINE SHOP

11. Drilling Holes using power drill on various metals
12. Reaming of holes
13. Familiarization of machine shop and equipments
14. Grinding practice

WELDING SHOP

15. Demonstration of welding equipment and safety precautions.
16. Making of Simple V- Butt joint by electric arc welding
17. Spot welding practice-making lap joint

ELECTRICAL FUNDAMENTALS

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Connection of cells in series & checking of voltage and current
2. Connection of cells in parallel & checking of voltage and current
3. Charging of lead acid battery
4. Charging of nickel cadmium battery
5. Trouble shooting & servicing nickel cadmium battery
6. Demonstration, operation of thermocouple
7. Demonstration of ohm's law, Kirchhoff's law
8. Demonstration of various resistors and checking the value of resistance and verification
9. Demonstration of wheat stone bridge
10. Demonstration of various capacitors and checking the value of capacitance and verification
11. Demonstration of various kinds of circuit protection devices
12. Demonstration of electrical meters (voltmeter, ammeter)
13. Partial disassembly of electrical meters & demonstration of internal parts

AIRCRAFT MATERIAL & HARDWARE**ANY TWELVE (20) EXPERIMENTS ONLY****DETAILS OF PRACTICAL**

1. Practice locking of bolts, screws on locking board
2. Typical wire locking practice on engine/ Aircraft
3. Familiarization of various types of locking devices used on a/c
4. Locking practice using various types of locking devices (Tab Washer, Pin etc.,)
5. Demonstration types of springs
6. Compression and tension testing of spring – (UTM)
7. Demonstration and identification of various types of rivets
8. Identification of various types of fluid lines and connections
9. Pressure testing of fluid lines
10. Demonstration, identification of various types of bearings
11. Inspection of bearing including clearance, condition of rollers, balls and for defects and corrosion
12. Removal of bearing ball races, inspection & installation
13. Demonstration & identification of various types gears
14. Inspection of gears, teeth clearance, fit and defects
15. Audio Visual demonstration of various types of gear functioning
16. Practice of checking and adjustment of cable tension on Aircraft
17. Inspection of cable, pulleys, fair lead, connectors, turn buckles etc.,
18. Practice of turn buckles locking
19. Identification & inspection of cable end fitting
20. Proof loading of cable
21. Identification of electrical cable and connectors
22. Demonstration of material hardness testing
23. Inspection of various aircraft/ engine parts/component for different type of corrosion and its identification
24. Chemical treatment of metals for surface protection
25. Audio visual demonstration of tube flaring, beading & bending
26. Metal identification by grinding wheel spark

ELECTRONIC FUNDAMENTAL & DIGITAL TECHNIQUE

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Demonstration & operation of half wave rectifier circuit with diode
2. Demonstration & operation of full wave rectifier circuit with diode
3. Identification of transistors
4. Testing of transistors
5. Demonstration of construction, operation & verification of OR gate circuit
6. Demonstration of construction, operation & verification of AND gate circuit
7. Demonstration of construction, operation & verification of NOT gate circuit
8. Demonstration of construction, operation & verification of NAND gate circuit
9. Demonstration of construction, operation & verification of NOR gate circuit
10. Demonstration of construction, operation & verification of XOR gate circuit
11. Demonstration of construction, operation & verification of XNOR gate circuit
12. Demonstration of various input devices of computer
13. Demonstration of various output devices of computer
14. Familiarization with various data buses

JET ENGINE – I

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Demonstration & identification of basic construction, arrangement of turbojet engine
2. Demonstration & identification of basic construction, arrangement of turbo-shaft engine
3. Demonstration of basic construction, arrangement of turbofan engine
4. Demonstration of basic construction, arrangement of turboprop engine
5. Engine cowling removal, inspection & fitment
6. Demonstration of various types of combustion chambers
7. Demonstration of thrust reverser bucket operation
8. Identification of oil system components
9. Replenishing of oil in the oil tank
10. Removal of oil filters, inspection, cleaning & fitment
11. Identification of fuel system components
12. Removal of fuel filter, cleaning & fitment
13. Pre-flight inspection as per schedule

AIRPLANE DYNAMICS & STRUCTURE

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Demonstration of various aerodynamic balances
2. Demonstration of various lift and drag inducing devices
3. Demonstration of primary and secondary structure
4. Demonstration of various method and parts of fuselage construction
5. Detail inspection and examination of fuselage structure and construction
6. Detail inspection and examination of various method and parts of main plane construction
7. Detail inspection and examination of fuel tank
8. Demonstration inspection of various types of landing gear and attachment
9. Demonstration of construction of doors, windows, emergency exit and inspection panel
10. Inspection of aircraft for alignment and distortion
11. Demonstration of mass balancing of control surface

MAINTENANCE PRACTICES – I

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Removal of damaged rivets & de-riveting from aircraft structure
2. Preparation for riveting: - marking out, cutting of metal sheet
3. Practice of riveting with solid rivets
4. Practice of riveting with blind rivets
5. Post riveting inspections & familiarization with riveting faults
6. Riveting practice by pneumatic riveting gun
7. Practice of tube cutting & flaring
8. Practice of tube cutting & bending
9. Inspection of metal pipelines for condition and defects
10. Inspection & familiarization of various defects on flexible pipelines
11. Identification and inspection of various support clamps
12. Practice of swaging
13. Testing of tubes and flexible hoses
14. Inspection and maintenance of ground equipment

PISTON ENGINE – II & PROPELLER

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Identification and inspection of various parts of propeller
2. Propeller track checking on aircraft
3. Removal inspection & fitment of fixed pitch propeller
5. Disassembly identification and inspection of various parts of pitch change mechanism and reassembly
6. Identification and Inspection and repair of metal propellers
7. Propeller static balancing and fitment
8. Fifty hours inspection as per scheduled, issuance of CRS and making logbook entry
9. Hundred hours inspection as per scheduled, issuance of CRS and making logbook entry
10. Engine removal from Cessna Aircraft
11. Preparing engine for storage/transit
12. Removal engine from storage and preparing installation
13. Engine installation on aircraft, ground running and checking parameters

MAINTENANCE PRACTICE –II

ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Sheet Metal bending to shape calculation of bends allowance set back and marking
2. Patch repair practice- insertion octagonal patch
3. Repairing of a/c skin by overlap patch
4. Demonstration of Shrinking and joggling
5. Forming sheet metal by pressing and rolling
6. Inspection of sheet metal work on aircraft
7. Aircraft Towing Practice
8. Aircraft Jacking up Practice
9. Aircraft Refuelling and Defueling Practice
10. Aircraft Choking and mooring Practice
11. Crack Detection by Dye penetrant Method
12. Crack Detection of Ferrous Metal
13. Inspection of Welded Joint
14. Demonstration of Tin soldering brazing
15. A/C marshalling practice

AIRPLANE SYSTEM
ANY TEN (10) EXPERIMENTS ONLY

DETAILS OF PRACTICAL

1. Demonstration and identification of heating and ventilating system Cessna Aircraft
2. Inspection of cabin heating and ventilating system Cessna Aircraft
3. Demonstration and identification Air-conditioning Air distribution on Lear jet a/c
4. Demonstration and inspection of air-conditioning system (VCM) in Lab and functional test.
5. Removal, inspection, servicing and functional test of cold air unit at mock up
6. Demonstration and inspection of fire detection system on Lear jet a/c
7. Removal of fire bottle, weighing and fitment
8. Demonstration, inspection of fuel system on Lear jet a/c
9. Removal, inspection and fitment of seat
10. Inspection of seat belt, life jacket.
11. Pre flight inspection
12. Fire fighting exercise at Aircraft

JET ENGINE MAINTENANCE
Any TEN (10) Experiments Only

DETAILS OF PRACTICAL

1. Removal of oil temperature sensor, inspection, fitment & functional test
2. Removal of oil pressure sensor, inspection, fitment & functional test
3. Flushing of oil tank of Lear jet aircraft
4. Fuel pressure sensor removal, inspection, fitment & functional test
5. Inspection of cold zones of engine
6. Inspection of hot zones of engine
7. Crack detection methods used on engine parts during inspection
8. Inspection of turbine blades
9. Cockpit layout of various engine controls and operation
10. Preparation of engine for removal
11. Removal of engine from aircraft
12. Installation of engine to the aircraft
13. Preparation of engine for ground running after maintenance
14. Demonstration of motoring /wet motoring on engine
15. Demonstration of Ground running of the engine and parameters recording

PISTON ENGINE MAINTENANCE

DETAILS OF PRACTICAL

1.
 - A) Complete dismantling of engine (C-90) and laying out components for inspection
 - B) Visual and dimensional inspection of components
 - C) NDT test on dismantled components
 - D) Re assembly of dismantled engine

2. Partial dismantling of aircraft engine (0-200)
 - A) Top over haul of aircraft engine (0-200)
 - B) Removal of components such as magneto, carburettor starter generator, spark plug
 - C) Inspection and testing of removed component
 - D) Re building of engine
 - E) Rigging of engine control

3. Test run of re built engine
 - A) Recording of parameters
 - B) Fault finding and rectification
 - C) Log book entry of component removal and top overhaul

4. Compression testing on aircraft engine

5. Induction system fault/defect simulation and repair

6. Fuel system fault/defect simulation and repair

7. Oil system fault/defect simulation and repair

8. Ignition system fault/defect simulation and repair and testing

9.
 - A) Study of defect/damage on engine
 - B) Selection of repair scheme
 - C) Repair of engine, component as per selected scheme
 - D) Functional test / strength test after repair
 - E) Making log book entry and documentation

10. 400 hours inspection on aircraft as per scheduled, issuance of CRS and making logbook entry

HEAVY AEROPLANE MAINTENANCE
Any Eight (08) Experiments Only

DETAILS OF PRACTICAL

1. Inspection, servicing of flight control cable push pull rod and associated components
2. Aircraft symmetry check including fuselage alignment check
3. Accumulator servicing
4. Hydraulic pump removal, servicing, installation and functional test
5. Main landing gear servicing, inspection
6. Main landing gear alignment check
7. Main landing gear chock strut charging
8. Nose steering system examination servicing and functional test
9. Cabin structure inspection and simulated pressure leak test
10. 100 hrs inspection

LIGHT AEROPLANE MAINTENANCE
Any Twelve (12) Experiments Only

DETAILS OF PRACTICAL

1. Removal Inspection of aileron control
2. Removal Inspection of elevator control
3. Removal Inspection of rudder control
4. Removal Inspection of flap
5. Removal Inspection of main plane
6. Removal Inspection of tail plane
7. Removal Inspection of fin
8. Inspection of condition of fuselage alignment checks, freedom from distortion
9. Symmetry check and rigging
10. Wheel removal, inspection and fitment
11. Removal of brake unit, disassembly, inspection, fitment and functional check
12. Inspection servicing and charging of shock strut
13. Inspection servicing of landing gear
14. Aircraft seat removal, inspection and fitment
15. Wing fuel tank emptying, structural inspection, vent system checking
16. Hundred hours inspection of Cessna aircraft as per maintenance schedule, issuance of CRS and making log book entry
17. Inspection and cleaning of A/C wind shield

HELICOPTER DYNAMICS AND FLIGHT CONTROL
Any Ten (10) Experiments Only

DETAILS OF PRACTICAL

1. Demonstration of Major components of Helicopter
2. Demonstration of cyclic and collective controls
3. Demonstration of Tail Rotor control
4. Demonstration of fixed and semi rigid Rotor head
5. Demonstration of construction details of main rotor blades
6. Demonstration of construction details of tail rotor blades
7. Demonstration of trim control
8. Demonstration of vertical and horizontal stabilizer
9. Demonstration of track check of main rotor by flag method
10. Demonstration of main transmission system components
11. Demonstration of tail rotor transmission system components

HELICOPTER SYSTEM
Any Twelve (12) Experiments Only

DETAILS OF PRACTICAL

1. Demonstration of Robinson helicopter fuel system
2. Demonstration of indication and warning in fuel system
3. Demonstration of fuelling & defueling of Robinson helicopter
4. Demonstration of a typical helicopter hydraulic system
5. Demonstration of components in a typical helicopter hydraulic system
6. Demonstration of indication and warning in a typical helicopter hydraulic system
7. Demonstration of a typical de-icing system
8. Demonstration of a typical anti icing system
9. Demonstration of a typical landing gear component
10. Demonstration of a typical shock absorption system
11. Demonstration of a typical extension/retraction of landing gear system
12. Demonstration of indication and warning system in a landing gear system
13. Demonstration of a typical fire and smoke detection system
14. Demonstration of Various fire extinguishing system
15. Demonstration of various types of wheels
16. Demonstration of various type of brakes
17. Demonstration of a typical pneumatic system
18. Demonstration of indication and warning system in typical pneumatic system

HELICOPTER MAINTENANCE
Any Twelve (12) Experiments Only

DETAILS OF PRACTICAL

1. Familiarization of maintenance schedules' and manuals
2. Inspection and maintenance of bearings used in helicopter
3. Inspection and maintenance of skid type landing gear
4. Inspection and maintenance after tail skid strike in Robinson helicopter
5. Inspection and maintenance after tail rotor strike in Robinson helicopter
6. Inspection and maintenance after main rotor strike in Robinson helicopter
7. Heavy landing checks in Robinson helicopter
8. Towing procedure and practice in Robinson helicopter
9. Tie down and mooring practice in Robinson helicopter
10. Demonstration of jacking, levelling and hosting of helicopter
11. Practice of refuelling of Robinson helicopter
12. Practice of defueling of Robinson helicopter
13. Seat removal, inspection, servicing and installation
14. Inspection servicing of fuel tank
15. Washing and cleaning of helicopter
16. Servicing of ground handling wheels
17. Pre flight/daily inspection scheduled and issuance of CRS
18. 29 Hrs scheduled inspection of Robinson helicopters
19. 50 Hrs scheduled inspection of Robinson helicopters

GEARBOX AND ROTOR MAINTANANCE

Any Twelve (12) Experiments Only

DETAILS OF PRACTICAL

1. Log book maintenance and making of entries
2. Draining and flushing of MGB
3. Draining and flushing of TGB
4. Removal of main rotor blade
5. Removal of main rotor hub
6. Inspection of main rotor blade
7. Inspection of main rotor hub
8. Installation of main rotor head
9. Installation of main rotor blade
10. Removal inspection of tail rotor blade
11. Removal inspection of tail rotor head
12. Installation of tail rotor head
13. Installation of tail rotor blade
14. Inspection servicing of control system – collective and cyclic
15. Inspection servicing of control system –tail rotor controls
16. Inspection servicing of transmission system component
17. Vibration analysis and rectification methods