AIRCRAFT STRUCTURES Hours Alloted:50

1. Structural principles: Definition of centre of gravity, effects of movements of center of gravity. Definition of stress/strain, compression, tension, bending and shear and interaction of the above in typical aircraft construction. Principles of loads and stresses, weight analysis of typical structure, strength and rigidity, airworthiness requirements of structural strength, fatigue life, fail-safe design. Knowledge of damage tolerance, SSID and corrosion prevention and control program. Constructional features of integrals fuel tank/wing box structure, load paths stressed skin- diaphragms and longerons, wing spar and rib structures, empennage, fatigue effects and control, pressure loaded skin, bulk heads, windows, wind screens, doors, milling/ chemically etched structures, bonded construction, fasteners-close tolerance types and sealing compounds.

2. Truss type, semi-monocoque and stressed skin construction. General constructional features and load carried by spar, web, rib, stringer, longhorn, struts, wires and tie rods. General constructional features of aircraft doors and nacelles. Constructional features of various engine mounting arrangements and structures. Description of engine pylon mounting system. Description of various forms of wing construction - monospar, multispar (including false spar) and box beam. Constructional features of primary and auxiliary structure. Methods used to statically and aerodynamically balance control of aircraft based on engine type and installation. Wing and tail configuration speed, etc. and merits and demerits of them.

3. Control cables: construction features, function, inspection and maintenance of cables, cables and fittings, pulleys, guards and fair leads and control chains (including meaning of the terms relating to dimensions) methods used to assess their wear, elongation and distortion of chain sprockets. Storage and corrosion protection requirements of chains. Constructional features, functions applicability and adjustment procedures of the following: bellcranks, quadrants, and levers, torque arms, push-pull rods and their end features.

4. Fabrics & doping: Common types of fabrics currently in use & their characteristics. Common types of dopes, cords and threads currently in use and their uses, advantages and disadvantages. Definition of the following textile terms: thread count, wrap waft (wood or fill), selvedge, pinked edge, seam minimum tensile strength new (undoped), minimum tensile strength deteriorated (undoped), weight strength , mercerized and bias. Common types of dopes, thinners, primers, paints, fungicides, rejuvenators, cleaning agents and cements used on fabric covered aircraft. Main physical characteristics and compatibility's of the above mentioned products. Storage requirements of the above. Description of main finishing

problems while using dopes, including causes and methods used to correct or overcome them.. Tensile strength requirements in relation to airspeed and methods of testing for tension in new undoped fabrics and existing doped fabric covers. Inspection required prior to recovering the aircraft structure. Sequence of events in fabric applications including doping and painting. Different methods of attachments of fabric to metal, wood and plywood. Method of removing dope from fabric.

5. .Preparation of fabric prior to rib stitching and methods of single and double rib stitching including the considerations in the choice of either methods. Different knots and their uses. Consideration behind the use of anti-tear tape including its Their location, size, shape and approximate to structural members. Description of the methods used to create drainage holes and the location. General oratorio used in fabric repair scheme and general steps involved in preparing a patch, doping on the patch and reapplying the aircraft paint scheme to the patched areas.

6. Structural Timbers: common species of wood used in aircraft structure and their general characteristics. Maximum grain deviation in structural timbers and permissible and non-permissible defects, their causes and identification of characteristics. Explanation of the requirements to determine moisture content of aircraft timbers prior to use. State tests applicable, sample selection, number of Samples and seasoning. Effects of high moisture content of wooden aircraft parts. Definition of annual rings, spring wood, sapwood, heartwood, grain, knot, check, shake, compression wood, dote and conversion of timbers.

7. Preparation requirements for wood surface prior to gluing. Tests to determine the presence of oil, grease or wax on the surface. Types of glue used for wooden construction, their properties and their special characteristics. Description of the method of application and the ecommended pressure for hardwoods and soft woods. Precautions to be observed during the gluing process. Definition of pot life, open assembly and closed assembly.

POWER PLANT - PISTON ENGINE (part I) Hours Alloted:50

8. Theory & construction : conversion of heat energy to mechanical energy and the relationship between volume, pressure and temperature, thermodynamic laws related to internal combustion engines. General knowledge of the otto cycle and relation between P/V & T. requirements for effective combustion. Definitions of stroke. TDC, BDC, swept volume and clearance volume.

9. Principle of heat engine-internal combustion engines, Otto cycle and cycle efficiencies. Difference between two stroke and four stroke operating cycles. Description of inlet and exhaust valve operating cycle. Definition of valve head, lag and overlap and reason for incorporation in the valve operating cycle. Description of the layout and typical firing order of opposed, inline, v and radial engines.

10. Definition and calculation of mechanical, thermal and volumetric efficiencies. Definition and measurement of piston displacement, compression ratio, manifold pressure. Calculation of piston displacement and compression ratio.

11. Construction, function and classification of cylinders, piston, piston rings, piston pins, connecting rods, inlet and exhaust manifolds. Construction and function of rocker assembles. Push rods, cam followers, tappets, inlet and exhaust valves, between crankshaft and cam configurations. Construction, function & classification of crankshaft, cam shafts, cam rings, accessory/reduction gear boxes. Calculation of reduction gear ratios and drive directions.

12. Definition of Horse power/kilowatt, indicated horse power, brake horse power, friction horse power, indicated mean effective pressure, break mean effective pressure and friction mean effective pressure, specific fuel consumption, calculation of BHP and IBP and BSFC. Relation between fuel consumption and engine power. Effective of altitude, humidity, temperature and icing on engine power. Definition of stoichiometric mixture, rich best power mixture, lean best power mixture and cruise power mixture. Symptons and causes of detonation, pre-ignition, after firing, back firing, effect of lean and rich mixture burn rates on engine performance.

AIRCRAFT SYSTEMS PART I Hours Alloted: 60

13. Hydraulic system: relationship between pressure, force and area and method of solving problems related to differential areas and pressures and mechanical advantage. Pascals law and problem solving. Identification of hydraulic fluids by name, MIL spec. or color and their properties and precautions to be observed when using them. Identification of seals used in hydraulic system by color code and their use. Principles of their operation and maintenance, tools used in the installation and removal. Identification of flexible hoses, material of construction and its operating pressure range and the fluid compatibility with it. Knowledge of information printed on hoses.

14. Procedures, equipment used and precautions to be observed when fabricating rigid and flexible fluid lines for use in aircraft. Identification of hydraulic system fittings and attaching parts by name and their uses in the system. Identification of components, their function and their constructional features of a hydraulic system. Description of general hydraulic system, maintenance practices. Constructional features and the principle of operation of hand and power hydraulic pumps. Location, function and relationship between the following components of a hydraulic power supply system: reservoir, pumps, regulating valves, relief valves and reducing valve.

15. Pneumatic system: Principles and uses of high pressure air system in an aircraft. Identification of components, their constructional features, function, and the effects of faults in a pneumatic system. System using bleed air, bleed air valves, mass - flow, pressure and temperature control and their indication. Alternate supply - APU and ground cart.

16. Landing gear system: constructional features and the function and maintenance procedures of the following : shock cords, spring steel struts, air - oil oleo struts, spring - oleo struts, tail wheel and taxi skid assemblies, floats, shimmy dampers, torque links, actuating cylinders, drag braces, safety devices indications.

17. Types of landing gears - nose wheel, tail wheel, BI-cycle type tricycle type, multi wheel & skids : advantages and disadvantages of different types. Description of the assembly and principles of operation of the following systems; Nose wheel steering, retractable landing gear and emergency extension. Description of function, operation and components of anti-skid system. Description of system - ground and inflight.

18. Constructional features of aircraft tires and identification of tires by their markings. Advantages and disadvantages of tires with tube and tubeless tires. Aircraft tires charging medium and precautions to be observed during inflation and deflation of aircraft tires. Various types of wheels used on aircraft and their applications.

19. Construction, operation, function, inspection and maintenance of : single and dual servo brakes expander tube brakes (hydraulic and pneumatic) disc brakes (single and multiple) and master cylinders. Inspection of the under carriage shock absorbing legs, breaks, wheels and tires. Principles of operation of retracting under Carriage operation system. Inspection of aircraft following heavy landing and over weight landing.

20. Fuel system: construction operation, function, inspection and maintenance of the following: pumps, strainers, filters, valves, tanks, fuel heaters and primers. Identification and location of fuel system components. Layouts and the operation of typical piston and gas turbine engined aircraft fuel system including the instrument and electrical interface.

AIRCRAFT INSTRUMENTS PART I Hours Alloted:40

21. Terminology & conversion: knowledge of the following instrument related terms: hysteresis error, parallax error, absolute, differential and gauge pressure. Methods of compensating instrument mechanism for temperature variation and the reasons for hermetically sealing instruments. Conversion of measuring units from one system to another.

22. Different layers of the atmosphere and variation of pressure, temperature and density with altitude. Requirements of the ICAO standard atmosphere and description of the methods by which atmospheric pressure is measured. Construction, operation and function of capsules, diaphragms, bellows and Bourdon tubes. Operation of aneroid and mercury barometers in measuring atmospheric pressure.

23. Pitot - Static Instruments : description of related terms, construction and operation of pitot, pitot/static probes and static vents, the layout of a typical system. Pressure error and its effects on pitot static instruments. Knowledge of pitot static leak test as laid down in AND 108.56.

24. Construction and operation of counter pointer and servo altimeters. Effects of variation in temperature and atmospheric changes on their indication. Definition of QFE, QNE and QNH. Description of how altimeter pointer settings are accomplished and effect of setting QFE, QNH and QNE and their reading on altimeter. Description of their effect, friction, scale error and Barometric scale error, related to altimeter. Description of the test for altimeters as laid down in AND 108.56. knowledge of term Flight Level related to the height of the aircraft when the altimeter is set to 1013.2 millibars. Knowledge on construction, operation and function of typical altitude alerting and reporting systems including encoding altimeters.

25. Definition of indicated, calibrated, and true air speed, speed of sound, sonic, subsonic, transonic and supersonic mach number and critical much number, velocity maximum operating (VMO) and maximum mach operation (MMO). Construction operation and function of air speed indicators and Machmeter. Description of test of airspeed indicators as laid down in AND 108.56

26. Construction and operation of vertical speed indicator and instantaneous vertical speed indicators. Metering unit rate and time-lag factor.

27. Engine instruments, construction and operation of Direct Reading pressure and capillary type pressure and temperature gauges.

28. Definition of static air temperature and total air temperature and the measurement of the above. Knowledge of bridge circuits and measurement of unknown resistance from a given data. Operation and construction of various thermocouple type indicating systems. Description of cold junction compensation of various types and materials used in the operation of thermocouple leads and probes. Construction and operation of radiation pyrometer type temperature indicating system. Construction, operation and advantages of ratio meter type indicators.

29. Construction, operation and adjustments of fuel flow and fuel quantity indicating systems (float and capacitance type) effect of change in temperature on the system. Construction and operation of DC desyn and selsyn systems. Construction, operation and maintenance of mechanical and electrical speed indicating systems and synchroscopes and the associated components. Construction operation and maintenance of manifold pressure gauge, torque meters, exhaust gas, temperature gauges, engine pressure ratio gauge, turbine inlet temperature gauges, engine vibration indicators and AC indicators.

30. Introduction to gyroscopic instruments - definitions - basic construction and operations types of Gyroscopes -PRESENTATION on A/H, TSI and D.G.

Automatic control fundamentals - type of AFCS construction and principal of operative of servo motor. Basic auto pilot control, stability augmentation and rate damping.

Stall warning system: purpose, component, operation of stick shaker.

BASIC AVIONICS: Hours Alloted:60

31. Introduction terms such as information, message and signal, channel, noise and distortion.

32. Modulation and demodulation.

33. Encoding and decoding

34. Basic principles of Radio Radiation of electromagnetic (e.m) waves and Antenna, Digital system, Microcomputers.

35. Categorization of Airborne Radio equipment - frequency and Modulation, Analogue - Digital Interface.

36. Communication systems - VHF communication, Basic principles Installation, controls & operation, block diagram operation.

37. HF communication - basic principles, installation, controls and operation, Block diagram operation.

38. Audio integrating Systems (AIS) Intercom - Introduction, Flight Interphone, Cabin Interphone, Service Interphone, Passenger address, Passenger Entertainment systems, Ground call systems.

39. Cockpit Voice Recorder.

40. Automatic Direction Finding - Basic Principles, Loop antenna sense antenna, Block diagram operation.

41. VHF. Omni directional Range (VOR), Basic principles, Doppler VOR (DVOR), controls and Operation.

42. Instrument landing system - Introduction, Basic Principles, controls and Operations.

43. Hyperbolic Navigation system - General Principles, Omega Navigation system (ONS) - Basic Principles & Operation.

44. The deccan Navigation - Introduction, Principles and Utility.

45. Distance Measuring Equipment (DME), Basic Principles, Installation and Operation.

46. ATC transponder - Basic Principles, system Operation and Utility.

47. Weather Radar - Introduction, Basic Principles, Installation and Controls, Application of Weather Radar.

48. Doppler Navigation - introduction, Doppler Effect Installation Control and Operation.

49. Radio Altimeter - introduction, principles of operation.

50. Current and future developments - Satcom and satnav, Micro Landing System, Microwave Aircraft Digital Guidance Equipment.

51. Recorder System - Flight Data Recorder - Basic Principles Controls and Operation, Encoding and Decoding.

AIRCRAFT SYSTEM PART - II Hours Alloted:95

52. Air conditioning systems: definition of sensible heat, latent heat, adiabatic conduction, conviction and radiation. Charle's law and how this relates to transfer of energy in an air-conditioning system. Identification of compressors, evaporators, receiver, expansion valves, condensers, lowers and isolation valves of a vapor cycle system. Construction of the features, principles of operation, location and function of a typical system. Type and characteristics of reference and oil used in the system. Identification of heat exchanges, air cycles machine, water separators and humidifies of an air cycle system and description of their operating principle. Function of components in basic air cycle system. Procedures and list of equipment used to carry out purging and charging of a vapor cycle system. Description of the operation, trace air flow in given configuration of an air cycle system and identification of faults including the electrical and instrument interface from given information.

53. Pressurization system: definition of pressure altitude, cabin altitude and differential pressure, maximum differential, control leaks and uncontrolled leaks, isobaric control mode and differential control mode. Identification and principle of operation of pressure controllers, outflow valves, safety valves, cabin altimeters, cabin differential pressure indicator, cabin-rate-of-climb indicators, pneumatic relays, manual pressure control valves, jet pumps, safety switches and negative pressure reading valves of typical pressurization system. Layout, operation and component function of a given system including the electrical interface. Diagnosis of fault in aircraft pressurization system and rectification.

54. Flight control systems: Primary flight controls architecture, secondary control systems like flaps, leading edge flaps and slats, slots, yawdamper, rudder boosts, trimmable horizontal stabilizers and various tabs.

55. Oxygen system: description of the human requirements for oxygen versus altitude including the effect of oxygen. Means of identifying oxygen cylinders and chemical units for use in aircraft. Safety precaution to be observed during servicing and maintenance of oxygen system. Means of identifying oxygen charging rigs. Description of assembling, operation, inspection, servicing and maintenance. Requirements of both chemical and gas oxygen systems for use both in flight and passenger compartments from given information and / or diagram. Differences in principles of operation and application of continuous flow demand, diluter demand, pressure demand, type of regular systems.

56. Fire Detection and Protection system: Description of the three methods of controlling the fire. Construction, operation testing, troubleshooting and maintenance of the following types of the fire detection systems. Thermal switch, thermocouple, continuous loop, continuous element or pressure type sensor responder. Description of typical fire extinguisher system fitted to both reciprocating and gas turbine engine aircraft. Inspection and maintenance of requirements of both detection and extinguishing system. Properties of extinguishing agents.

57. Ice and rain protection system: description of the effects of ice on an aircraft, construction, operation, function, inspection, maintenance and typical layout of anti-ice system (electric, chemical, thermal), de-icing system (electric, pneumatic and chemical)

chemical rain repellent systems, pneumatic rain removal, ice detection system, water and toiler drain heaters and wind shield wipers. Requirements for ground de-icing of aircraft.

PISTON ENGINES SYTEMS Hours Alloted:65

58. Principles of operation and construction of typical float chamber carburetor and fuel air ratio and its strength. Difference between down draft and updraft configuration. Description and operation of throttle valves, main/idle jets, power enrichment systems, float chambers, discharge nozzles, accelerator pumps and mixture control system. Cause and effect of impact, throttle and fuel ice on engine performance. Conditions for use of carburetor/ induction icing and its prevention. Principle operation and construction of pressure injection carburetor and fuel injection carburetor. Function and operation of fuel/air metering forces, impact tubes, venturi flow dividers, throttle valve, altitude mixture controls, fuel nozzles and fuel injection pumps.

59. Testing of fuels for contamination and suitability.

60. Identification of the types of piston engine fuels and their application. Description of the following characteristics of piston engine fuels: volatility, resistance to gum deposit forming, anti-corrosive properties vapour pressure, octane number, performance number, specific gravity, anti knock, additive octane rating, Reid vapor presure test and number, detonation, pre-ignition and flame propagation. Common sources of contamination in fuels and description of the methods used to ensure purity of the fuel, both in the aircraft and prior to refueling.

61. Characteristics of lubricants used in piston engine oil system. Contamination of oil and its identification. Properties of lubricating oil-purity, viscosity, viscosity index, grading, flash point, fire point, detergent and non-detergent types.

62. Description of operating principles and constructional features of wet and dry sump lubricating systems. Suitability of each for typical engine configurations. Description of the constructional features and operation of pressure pumps, scavenge pumps, oil coolers, oil cooler regulators. Oil tank/hoppers, relief valves, check valves, oil filters and oil dilution system. Description of cooling functions of the oil systems.

63. Ignition and starting system: principles of operation of magneto ignition. Definition of flux eddies, E-gap and flux reversal. Functions of contact breakers, condenser, distributor and screening of magneto ignition system. Difference between primary and secondary systems. Construction of polar inductor and rotating magnet magnetos. Difference between high and low tension ignition systems and advantages and disadvantages of each system, difference between battery and magneto ignition system. Description, operation and construction of booster coil, induction vibrator and impulse coupling auxiliary ignition systems. Description of the procedures for magneto timing and magneto to engine timing. Calculation of magneto cam speed for a given magneto cam configuration. Effect of magneto points gapping. Difference between advance/retard ignition timing. Operation of magneto switches. Construction and function of a compensated cam.

64. Construction of spark plug: description on temperature, classification and reach.
Inspection, servicing, cleaning assembly and testing of spark plugs and leads. Effect of spark plug gap on performance. Diagnosing of engine condition by spark plug appearance. Various types of ignition harness, their constructional features, testing and repair procedures and screening methods.

65. Principles of the impulse coupling, ignition boosters and starters relays.
Interpretation of ignition and starting system circuit diagrams and determination of system operation and system faults.

66. Description construction and operation of typical intake and alternate air systems
and engine exhaust systems. Purpose and principle of supercharging and the effect on volumetric efficiency, change of density and temperature, brake horse power, manifold absolute pressure, detonation, revolution per minute and fuel consumption. Description of construction and operating principles of geared supercharger and turbo supercharger system. Construction and function of impeller, diffuser, engine gear drive turbine and inter cooler. Difference between internal supercharger and external turbo super charger, multistage and multi speed supercharger. Difference between ground booster and altitude engines.

67. Operation and layout of systems consisting of absolute pressure controller, ratio controller, manifold pressure relief valve and waste gate assembly. Operation and layout of a system consisting of density controller, differential pressure controller and waste gate assembly. Operation and layout of a system consisting of variable absolute pressure controller and waste gate assembly. Operation and function of a system consisting of ground adjustable waste gate valve, manifold pressure relief valve. Description of the operation and construction of all system components and installation procedures.

PROPELLERS Hours Alloted:50

68. Principles of operation and terminology: description of the blade element theory. Description of how the following affect propellers thrust: High / low blade angle and reverse angle, angle of attack, pitch coarse/ fine-high/ low and rotational speed. Definition of propeller slip. Explanation of how the following forces affect rotating propeller blade: Aerodynamic, Centrifugal, torque and thrust. Effect of change in the direction of relative airflow on blade angle of attack.

69. Configuration and type: description of the following type of propellers: Fixed pitch, ground adjustable, controllable pitch, constant speeding and contra rotating.

70. Construction, assembly and installation: definition of hub assembly, blade face, blade back, blade shank, blade stations and reduction gears, assembly and housings. Description of the construction and specific materials used in composite, metal and wooden propellers and protection finishers. Description of typical mounting, balancing and tracking of procedures for tapered and spliced propeller installations.

71. Pitch change mechanism: description of the operation of mechanical, hydraulic, aerodynamic and hydraulic combination and electrical type pitch change mechanism

72. Propellers auxiliary systems: Description of operation of the following: Ice protection/ elimination, synchronizing synchrophasing, negative torque, thrust sensitive, autofeather, propeller brakes, decouplers, un-feathering accumulators and auto-feather systems.

73. Governors: Description of the operation of a typical Governor. Description of the effect of variations in spring pressure and engine RPM on governor operations, difference between single and double acting governors. Description of the operation and function of speeder spring, pilot valve. Description of the following operational conditions: under speed, over speed, feathering, un-feathering and reverse pitch.

CORROSION PROTECTION & CONTROL Hours Alloted:50

74. Terminology: Surface Corrosion intergranular corrosion, Pitting corrosion Filiform and Exfoliation Corrosion. Galvanic Corrosion Microbial Corrosion stress Corrosion.

75. Conditions causing corrosion: Basic Factors of material and Assembly section of materials dissimilar metals heat treatment welding fretting stress high temperatures electrical equipment.

76. Factors Due to Environment and Operation Damage to protective coatings surface defects, crevice corrosion marine corrosion fuels, oils and other liquids.

77. Control of Corrosion: Cleaning Inspection Storage.

78. Corrosion - Removal and Rectification

79. Preliminary cleaning of corroded areas.

80. Removal of OLI protective coatings organic coatings, Chemical Coatings, Anodic Films, Chromate films, phosphate films, coatings, corrosion products.

81. Test for cleaning Chemicals

82. Chemical cleaning of : Steel, Aluminium Alloys, Steels, Magnesium Alloys.

83. Treatment of Components:

84. Degresing:- Aluminium Alloys, Steels, Magnesium Alloys.
85. Pickling Process, Chromic - Sulphuric Acid Process Phosphoric acid Process, Chromic Phosphoric Acid Process.
86. Pickling solutions
87. Electrolytic Pickling
88. Phospating Process.
89. Corrosion - Methods of Protection

90. Choice of Metal
91. Passivity
92. Surface Finish
93. Chemical Inhabitation
94. Sacrificial Protection
95. Mechanical Protection

96. Treatment of Aircraft Parts:

97. Chemical and Electro Chemical Treatment, Steel, Aluminium & Its Alloys, Magnesium Alloys, Zinc coating components, Metallic Coatings, Cadmium plating, Nickel & Chromium Plating, Metallizing, Flame Plating, Power Processes, Replating.

98. Organic Coating: Priming Coats, Cellulose finishes, Synthetic finishes, landing-resin finishing stoving finishes, epoxy finishing.

99. Special fuel tank treatments.

100. Testing Protective Treatment:
101. Chemical Treatments, Anodic Treatments of Aluminium Alloys
102. Coating thickness measurement
103. Electro-plated coatings.
104. The BNF Jet Test
105. Test for determination of adhesion
106. Organic finishes.
107. External Finishing of Aircraft: Surface finishing, Retouching local areas.

108. Internal Finishing of A/c.

GROUND HANDLING & SAFETY Hours Alloted:40

109. Introduction: Types of jacks, Jacking procedure, Towing procedure in general, light aircraft towing procedure, heavy aircraft towing procedure in night towing procedure.

110. Parking & picketing, tie down equipment procedure, Bottle jack, Tripad jack, Treastles light a/c jacking up procedure, heavy a/c jacking up procedure.

111. Purpose of levelling the a/c methods a) Spirit level b)Plumb bob c) Engineering Transist.

112. Purpose various ground equipment used for servicing aircraft a)Chocks, jacks, towing apparatus, picketing material, ladders, plat forms, trollies lifting cranes, hoisted, compressors, oil cans slings, etc.
113. Refueling appliances

114. Air charging compressor, high-pressure cylinder trolleys.
115. Oxygen charging trolls.
116. Oil charging rigs.
117. Lubrications:
118. Cleaning exterior services.
119. Cleaning internal structures.
120. Cold Weather precaution
121. Depressing & preventing ice formation
122. FOD checks
123. Be fire starting engine precautions
124. Marshalling of aircraft day and night

125. Purpose of Hydraulic Test Trolleys. Description, Operating procedure.

126. Purpose of Electrical Power Plants, Description, Operating Procedure.

127. Purpose of Air-conditioning Units, Description and operating procedure.

128. Ground support units purposes, Description & Operating procedure.

129. Fire Extinguishing Equipment.

AIRCRAFT MAINTENANCE PRACTICE Hours Alloted:40

130. General maintenance of aircraft, Maintenance of Jacks, Towing apparatus, chocks, Tresles, ladders, plat forms, air and oxygen trolleys, oil charging rigs etc.

131. Facilities of maintenance hangers.

132. Fire extinguishing equipment maintenance hangar.

133. Identification of fluids systems hydraulic pneumatic, oxygen, fuel, air conditioning oil
134. system pipelines, rigid and flexible pipelines, construction, removal and installation procedures, precautions.

135. Bending rigid pipelines, flaring the pipes, usage of end fittings unions, clamps, clits etc.

136. Swaging procedure.

137. Cable splicing procedure.

138. Care and maintenance on plastic materials, repair, cementing curing sanding, buffing and
139. Polishing acrylic and wind shields, windows, etc.

140. Purpose of weighing and balancing.

GAS TURBINE ENGINES (Basic ) Hours Alloted:60

141. Theory and construction: Relationship between the following: Force, work, power, energy,

142. velocity and acceleration. Typical problems solving of their application to gas turbine engine operation. Definition and description of the application to gas turbine engine operation of the following : Potential energy, kinetic energy, Newton's Laws of motion. Brayton cycle. Bernoullis theorem and thermodynamic laws. Description of basic construction arrangement and the relative merits of the following: turbo jet, turbo fan, turbo shaft and turbo properties advantages and disadvantages of the above engines.

143. Knowledge of the various factors affecting the engine performance. Knowledge ofcondition monitoring and performance monitoring.

144. Definition of the following conditions and description of the relationship between the following : gross thrust, net thrust, chocked nozzle thrust, thrust distribution, resultant thrust, thrust horse power, equivalent shaft horse power and specific fuel consumption. Typical problem solving using above terms. Definition derivation of thermal efficiency, mechanical efficiency and propulsive efficiency. Definition of by-pass ratio and engine pressure ratio. Description of the pressure, temperature and velocity of the gas flow as it passes through each section of the engine.

145. Inlet Ducts: Description of the purpose, construction and principles of operation of subsonic, supersonic and bell mouth inlet ducts. Effects on pressure, velocity and temperature of airframe through convergent, divergent, convergent-divergent ducts. Description of the effects of ram recovery and the cause of inlet duct loses.

146. Compressors: purpose constructional features and operating principle of single and twostage centrifugal compressors. Purpose and function of rotor blades, stator blades, fixed inlet guide vanes and glide form.

147. Purpose and advantages of combined axial and centrifugal compressor assembling.

148. Related advantages and disadvantages of centrifugal, axial and combined axial and centrifugal compressors. Definition and cause of compressor stall and search. Description of the following principle methods of airflow controls. Bleed valves, variable inlet guide vanes, variable stator vanes and blades. Definition and derivation of compressor ratio.

149. Combustion chamber: Purpose, construction features, principles of operation, advantagesAnd disadvantages of the following: Can type, can annular type, annular and reverse - flow annular type compression chambers. Description of primary / airflow, compression fuel / air ratio, overhaul fuel / air ratio and flame stabilization. Purpose, construction and principle of operation of simplex, duplex and spilt type and vaporizing type nozzles. Description of the purpose and construction of swirl chambers, air shrouds and discharge offices.

150. Turbine: description of the principle of operation and blade form and impulse, reaction and impulse - reaction turbines. Turbine blading and nozzle guide vanes and method of obtaining driving force for each. Description of the differences between the turbine power extraction requirements for turbo jet, turbo fan and turbo pro-engines. Description of turbine blades to disk attachment. Causes and effects of turbine blade stresses. Factor determining blade creep.

151. Exhaust: purpose, constructional features and operating principle of the exhaust system: Cone, tile pipe, propelling nozzle, cooling shroud and gas flow and straighter, purpose of convergent and convergent-divergent and variable area nozzles. Description of the purpose constructional features and operational on: engine efficiency, thrust produced. Purpose construction features and principle of operation of engine noise suppresses, Methods of reducing noise levels.

GASTUBINE ENGINE SYSTEMS Hours Alloted:100

152. Starting systems: Various types of starters, starting troubles,start valves.

153. Basic requirements, arrangements and principles of air distribution and anti-ice controlsystems, including internal cooling, sealing and external air services. Description on the relationship, location and operation of engine internal cooling/sealing system components, anti-icing/ de-icing system components, air distribution, air distribution / external services components, and air starting system components.

154. Engine Fuel and Oil system: Basic requirements, arrangement and principles of operation of gas turbine engine fuel control / metering systems, including : starting control, acceleration scheduling over speed governing, power limiting, temperature limiting air density/ altitude/OAT/ airspeed compensation and shut down control. Description of the relationship, location and function of the following: Main fuel pumps (HP &LP), fuel heater, fuel filters (HP & LP), pressurizing/ dump valves, fuel control unit - hydro pneumatic, hydro mechanical, electro-hydro mechanical, governors and limiter devices, engine sensing variables and valves (throttle/dump/shutoff). Determining fault location and rectification requirements of system faults.

155. Specification number and terminology associated with the identification of approved gas turbine engine fuels. Description of the following properties in relation to gas turbine engine fuels: specific gravity, caloric. Calorific value, energy per gallon, vapor pressure, flash point fire hazard, fuel icing and corrosion characteristics. Ground handling requirements and the safety precautions to be observed with the uses of gas turbine engine fuels. Description of the effect of the following on safety handling or inspection procedures: flammability, misting, evaporation rate, gum formation, corrosivity, contamination (water and dirt) and sampling.

156. Lubrication System: Basic requirements of a gas turbine and definition of the following: Low volatility, antifoaming quality, low acquires and cake deposit, high flash point and low pour point.

157. Description of the arrangements and principles of operation of typical of gas turbine engine lubrication system. Description of the following: Oil tank, oil pumps, pressure / scavenge a 1 filters / screens, oil coolers, oil jets, scavenge subsystem, vent system (air / oil separator) and valves (bypass / check / relief), trouble shooting of lubrication system faults.

158. Knowledge of the air oil system used on a typical gas turbine engine.

159. Power augmentation system: Basic requirements, arrangements and principles of operation of the following gas turbine power augmentation system and components, water ingestion and water / methanol ingestion. Description of the relationship, location and function of the engine power augmentation system components and the interrelationship between the augmentation system and fuel control system. Trouble shooting of the system faults. After burner system.

160. Fire protection system: Basic requirements, arrangements and principles of operation of typical turbine engine fire extinguishing system and its components including fire detection, warning and extinguishing fire wires and extinguishers.

161. Thrust Reversers: Knowledge of construction features and functions of various types of thrust reversers and their related components.

162. APU: General arrangements, intake and exhaust systems door operation, load controls, electrical outputs controls and management, speed control, safety features, ground/flight/altitude - limiting factors, mounting, fire protection and indicating system, bay cooling and ground running.

AIRFRAME INSPECTION PROCEDURE Hours Alloted:120

163. Description of the following terms: zones, fuselage stations, wing stations, water lines and butt lines as applied to the determination of location on, with in or around an aircraft. Description of the methods used to determine the following alignment symmetry checks: wing and Horizontal stabilizer for alignment, fuselage for twist and bending and complete airframe for symmetry, explanation of the following terms: rigging position, incidence angle, washing, washout, cathedral, dihedral, longitudinal dihedral, stagger, declare, cabin struts and inter plane struts.

164. Principles, functioning, operation, adjustments and control of precision instruments, components and apparatus required to be used during inspection, repair and overhaul of aircraft.

165. Precautions and considerations of cutting and drilling materials methods, materials and general principles involved in cementing and curing acrylics. Methods of finishing acrylic components by sanding, buffing, and polishing. General cleaning techniques and precautions for window and windshields.

166. Weighing and loading of aircraft: Weighing bridges, hydraulic weighing units, and strain gauge weighing devices. Methods of rectification and repair of minor defects. (Avionics) rigging of aircraft periodical inspection necessary to check the serviceability of the aircraft, Avionics.

167. Knowledge of various aircraft manuals, ATA system of classification, inspection
168. schedules and time limit.

169. Detailed knowledge of the various inspections such as heavy landing, lighting strike, over weight landing abnormal flight loads etc. familiarity of structural manuals, various types of repairs given by the manufacturer there in. incorporation of alternate / equivalent materials, raising up of modifications, repair schemes to the aircraft during overhaul.

INTRODUCTION TO HELICOPTER Hours Alloted:60

170. Description of various terms used in helicopter construction and functioning of each component of helicopters. Aerodynamics and theory of flight of the helicopter and flight controls including the following : Basic Airfoils, air flow characteristics, rotor disc, forces acting, lift, drag, thrust, weight and centrifugal drive (Hookes joint) effect, articulated / semi right / right rotors, lapping/dragging/feathering, climbing/loosing height, horizontal flight, main and anti-torque rotors, control translation lift / in flow / ground /effect, vortex/ ring effect, retreating blade stall, reverse flow, auto rotation / auto rotative forces / blade section, twin rotors.

171. A knowledge of the function, maintenance and inspection of helicopter structure and structural components, doors and windows, flying control system and servo units, transmission system including main rotor head, blade construction, balancing and tracking of main and tail rotor blades, balancing and tracking of main and tail rotor blades, gear boxes free wheel units, main and tail rotor brakes, shaft and coupling, electric hydrulic, pneumatic and fuel systems, landing gear (including shock struts and retracting devices), wheels, tyres, brakes, ice and rain protection system, fire warning and extinguishing systems, etc.. systems.

172. Lighting - strikes, periodic inspections necessary to check the serviceability of life saving and safety equipment. A knowledge of the principles of operation, function, testing and calibration to determine serviceability of pressure, gyroscopic, simple DC and AC operated instruments, pilot systems and automatic pilots. A knowledge of and the precautions taken during airframe maintenance, jacking, towing, parking, ground deicing, supplying ground power, refueling and defueling etc. A detailed knowledge of procedures and precautions necessary to avoid deterioration of airframe and associated equipment when the helicopter is out of use for extended periods.

ENGINE & PROPELLER INSPECTION PROCEDURE Hours Alloted:120
(PISTON & JET ENGINE)

PISTON ENGINE MAINTENANCE

173. Recommended procedure for the preparation, disassembly & cleaning of the engine for maintenance / top overhaul. Procedure for removing and replacing a cylinder and associated components. Procedure for the inspection of valve operating assemblies, cylinders, pistons, bearing and associated components after removal, strip down and disassembly. procedures for replacements of the inscription of Helicons and fitting of oversize studs. Procedures for refining of valves & valve seats. Procedure for fitting of piston rings, side clearance gap and the associated precautions and tolerances. Procedures for a cold cylinder check. Hard time and non - condition concept of maintenance of engines.

174. Description of the procedure for the adjustment and rigging of typical controls which govern engine operation. Identification of the effects of faults, control mal adjustments and rigging problems on the engine controls. Trouble shooting and rectification requirements for these faults.

175. Procedures for starting, ground run- up and stopping of engines. Diagnisation of defect encountered during engine starting and ground running and rectification of defects.

176. Determination of engine power output parameters and limitations by interpretation from power charts or graphs. Troubleshooting and rectification of defects and faults encountered during flight operations including detonation, pre ignition and ignition advances. Description of adjustment procedures, oil pressure, etc. associated with engine operation causes and remedial for vibration and prevention.

177. Determine from given information the dimensional limits, fits, alignment and clearance of the engine and components. Description of various techniques and types of equipment used to determine the dimensional parameters during engine repair/ top overhaul. Description of testing procedure and the use of equipment and tooling required for top overhaul/repair of an engine.

178. Maintenance - Radial engines : from the given information, describe the procedures of checking valve adjustment and timing of typical valve operating mechanism. Describe the procedures for removing and refitting piston and cylinder assemblies.

179. Jet Engine Maintenance: description of the basic requirements, arrangements and principle of operation of the following engine controls : Linkages and controls to and from propeller coordinator/ inter connector and fuel controls unit; units and components inter connected for emergency shut down: mechanical control inputs and outputs for electric fuel control system: throttle/power/condition levelers and linkages. Description of the relationship, location and function of engine. Mechanical control system units and components. Trouble shooting of engine mechanical control system faults.

180. Engine operation and ground running: description of general precaution and pre-start checks prior to ground running of a gas turbine engine. Description of recommended procedures for starting, ground run - up and trouble and stopping a gas turbine engine. Using given typical manufacturers procedures and data, trouble shooting engine and system malfunctions. Interpretation of engine power output and limitation charts and determine adjustments or rectification requirements, including trimming. Knowledge of periodical inspections, special inspection schedules and duplicate inspection of engine controls.

181. General requirements for the preparation of engines and accessories for installation following period of storage and preservation. General requirements for the preservation of gas turbine engine both installed (on wing) and stored.

182. Propeller Maintenance: selection and inspection of materials used in construction, repair and overhaul of variable pitch propeller and associated systems, inspection of completed propeller for correct assembly, adjustment, weigh & balance. Methods employed for correcting balance and checking of torque loading of blades, knowledge of installation of propeller to an engine.