



GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
TECHNICAL CENTRE, OPP. SAFDARJUNG AIRPORT, NEW DELHI

CIVIL AVIATION REQUIREMENTS
SECTION 2 - AIRWORTHINESS
SERIES 'L', PART II
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EFFECTIVE: FORTHWITH

Subject: Requirements for Examinations for Issue / Extension of AME Licenses.

1. Introduction:

Rule 61 of the Aircraft Rules, 1937 details the various categories of AME licence issued by DGCA for the purpose of aircraft certification. The Rule also lays down the basic educational qualifications and other requirements for acquiring the AME licence by an applicant. The details of the experience requirements for various categories of AME licence are mentioned in CAR Section 2 Series 'L' Part I.

This CAR introduces the system of modular examinations for fulfilling the knowledge requirements for the issue of aircraft maintenance license. For the purpose of transition of the examinations to the new system, the modular examinations will be held simultaneously along with the subject examinations (Papers I, II and III) till October 2011. After this date, the subject examinations will be discontinued and only the modular examinations will be conducted.

This CAR details the procedure for appearing in various examinations conducted by the Director General of Civil Aviation for Issue / Extension of Aircraft Maintenance Engineer's licence.

2. Knowledge Examination:

The knowledge examination for AME licence will consist of the following written papers

2.1 Subject Papers:

The subject papers will comprise of basic subject papers and a specific type paper. The subject papers will contain multiple-choice questions. The pass percentage in each paper will be 70%.

The subject papers will consist of the following:

a) Paper I – Air Law, Airworthiness Requirements & Human Performance

This paper contains questions pertaining to Aircraft Rules, Civil Aviation Requirements, and human factors etc. as in the syllabus. This paper will be common to all categories of AME Licence.

b) Paper II - Aircraft Engineering

This paper contains questions pertaining to general engineering, workshop practices, basic electricity and electronics, basic knowledge of computers etc. as detailed in the syllabus. This paper will be common to all categories of AME Licence.

c) Paper III – Basic Aircraft/ Power Plant/ Systems

This paper will contain questions on the basic principles and general theory of flight or power plants or electricity or instruments or radio systems as prescribed in the syllabus for each category of the AME Licence. There will be a separate question paper for each category of AME Licence.

Note1. The applicant, who passes papers I, II and III in a category, will not be required to appear any time thereafter.

Note2. Syllabus for subject papers is in Annexure 1.

3. General Requirements for appearing in the subject papers:

3.1 An applicant shall appear in Paper III of the written examination only after passing both Paper I and Paper II.

3.2 An applicant who scores less than 35% marks in a particular subject paper in two consecutive examinations / sessions will not be permitted to appear in that paper in the next examination / session. For instance, a candidate scoring less than 35% marks in a particular paper in June 2009 and October 2009 sessions will not be permitted to appear in the February, 2010 session examination.

3.3 The applicant shall appear in specific papers or attend the approved training course on a particular type of aircraft / engine / system only after he has passed all the basic subject papers relevant to the category of AME License.

- 3.4 Applicants from the Approved AME Training Institutes shall only be allowed to appear in the category relevant to the Scope of Approval granted to the Institute
- 3.5 An applicant will be allowed to appear for a maximum of two categories of AME license examination in a session.
- 3.6 An applicant will be allowed to appear for Paper III of additional category in the same stream after acquiring an additional six months experience.
- 3.7 To change over from Mechanical to Avionics Stream or Avionics to Mechanical Stream, an applicant will have to acquire an additional eighteen months experience in the particular stream to appear in the AME license examination.

Note. An applicant can acquire the concurrent experience in the 'Mechanical Stream' and 'Avionics Stream', provided the experience is duly logged by the AME and certified by the Maintenance manager.

- 3.8 Defence personnel (serving or retired) are eligible to appear in the AME license examination provided they meet the requirements of basic qualifications and experience as laid down in Rule 61 and CAR Section 2 Series 'L' Part I.

4. Experience Requirements for appearing in Subject Papers:

4.1 DGCA Approved AME Training Institutes:

- 4.1.1 The students who have completed one year of approved training curriculum may appear in Paper I (Air Law, Regulations and Human Performance) of AME license examination.
- 4.1.2 The students who have completed two years of approved training curriculum may appear in Paper II (Aircraft Engineering) of AME license examination.
- 4.1.3 The students who have completed two and a half years of the approved training curriculum may appear in Paper III of AME license examination.

4.2 Graduate Engineers Training (GET) Scheme:

- 4.2.1 Graduate Engineer Trainees (GETs) who are undergoing training in an organizations approved by DGCA under the GET scheme and who have successfully completed one year of training may appear for Paper I and II of AME examination.

- 4.2.2 GETs who have successfully completed two years of training under the GET scheme and have passed papers I and II, may appear for Paper III of AME License examination in their respective stream.
- 4.2.3 GETs shall be eligible to appear for Specific paper / undergo approved training in the relevant category after passing Paper III of that Category.
- 4.3 General Candidate:
- 4.3.1 A general candidate is eligible to appear in Paper I and Paper II after acquiring at least two years of aeronautical engineering experience.
- 4.3.2 A general candidate is eligible to appear in Paper III after acquiring three years of aeronautical engineering experience in the relevant stream / category.

Note. A general candidate is one who does not fall in the categories of candidates from AME training institutes and GET scheme.

5. Modular System of Examinations:

- 5.1 The modular examinations will consist of the following modules:

Module 1 – Air law and airworthiness requirements

Module 2 – Human performance relevant to aircraft maintenance

Module 3 – Maintenance Practices

Module 4 – Materials and Hardware

Module 5 – Electrical fundamentals

Module 6 – Electronic Fundamentals

Module 7 – Digital techniques, electronic instrument systems

Module 8 – Basic Aerodynamics

Module 9 – Turbine aeroplane aerodynamics, structure and systems

Module 10 – Piston aeroplane aerodynamics, structure and systems

Module 11 – Gas turbine engines

Module 12 - Helicopter aerodynamics, structures and systems

Module 13 - Piston engine

Module 14 – Propeller

Module 15 – Aircraft aerodynamics, structures and systems

Module 16 – Propulsion

Note. Syllabus for modules examination is in Annexure 2.

5.2 General Requirements for appearing in the module papers:

- 5.2.1 Modules 1, 2, 3, 4, 5, 6, 7 & 8 will be common for both Mechanical and Avionics streams.
- 5.2.2 Modules indicated in 5.2.1 and Modules 9, 10, 11, 13 & 14 will comprise Mechanical stream (aeroplanes and power plants).
- 5.2.3 Modules indicated in 5.2.1 and Modules 11, 12, 13 & 14 will comprise Mechanical stream (helicopters and power plants).
- 5.2.4 Modules indicated in 5.2.1 and Modules 15 & 16 will comprise Avionics stream.
- 5.3 All applicants will be required to pass common modules 1, 2, 3, 4, 5, 6, 7 & 8 in addition to the modules relevant to his/her AME license category to be eligible for obtaining AME license.
- 5.4 All modules which make up a complete AME license category must be passed within 5 year period of passing the first module. The five year time period will not apply to those modules which are common to more than one sub-category examination. A failed module may be retaken after at least 90 days following the date of failed module examination. The applicant who passes Module 1 through 8 will not be required to appear in these modules thereafter.
- 5.5 An applicant will be eligible to appear in modules 3, 4,5,6,7 & 8 only after passing modules 1 and 2.
- 5.6 An applicant will be permitted to appear in modules relevant to his/her stream only after passing the common modules 1, 2, 3, 4,5,6,7 & 8.
- 5.7 Candidate can appear a maximum of six modules in his/her respective stream in a session.

6 Experience Requirements for appearing in the module papers:

- 6.1 Applicants from DGCA approved training institutes:
 - 6.1.1 A student who has completed one year of approved training curriculum may appear in Modules 1 and 2.
 - 6.1.2 a student who has completed two years of approved training curriculum may appear in modules 3, 4, 5, 6, 7 & 8.
 - 6.1.3 A student who has completed three years of approved training curriculum shall be allowed to appear in modules relevant to his/her category of AME license.

6.2 GET candidates

6.2.1 A GET who has completed one year of approved training shall be allowed to appear in modules 1, 2, 3, 4, 5, 6, 7 & 8.

6.2.2 A GET who has completed two years of approved training shall be allowed to appear in modules relevant to his/her stream of license.

6.3 General candidates

6.3.1 A general candidate who has acquired at least 2 years of aircraft maintenance experience shall be allowed to appear in modules 1 and 2.

6.3.2 A candidate who has acquired at least three years of aircraft maintenance experience shall be allowed to appear in modules 3, 4, 5, 6, 7 & 8 of the examination.

6.3.3 A general candidate who has acquired at least 4 years of aircraft maintenance experience shall be allowed to appear in modules relevant to his/her stream of AME license examination.

6.4 Defence Service Personnel

6.4.1 An applicant who has acquired at least one year experience in civil aircraft maintenance environment shall be allowed to appear in modules 1,2,3,4,5,6,7 & 8.

6.4.2 An applicant who has acquired at least two years experience in civil aircraft maintenance environment shall be allowed to appear in modules relevant to his experience in defence services.

7 Allotment of Computer Number:

An applicant shall obtain a Computer Number for appearing first time in any of the AME License written examinations. This number is a permanent and unique number allotted to a particular candidate and the same must be quoted in all applications / correspondence with the CEO.

Note 1. The application for allotment of Computer Number can be downloaded from the DGCA website <http://dgca.gov.in>. The duly completed application form along with required documents should be forwarded to Director of Airworthiness (CEO), O/o the DGCA, East Block III, Level III, R.K. Puram, New Delhi – 110066. The candidates are advised to ensure that they meet the eligibility requirements for allotment of computer number.

Note 2. Allotment of Computer Number does not imply an applicant's acceptance for appearing in any written examination. For appearing in the written

examination, the applicant must meet the eligibility requirements stated in the relevant Aircraft Rules and Civil Aviation Requirements.

Note 3. Applicants from training institutes and GETs should apply for computer no. soon after admission, through the respective training institutes.

8 Personal Log Book:

All applicants should maintain personal log book wherein all the experience gained on aircraft, engine and systems should be mentioned system wise indicating the type of schedule carried out. This work should be certified by the Engineer-in-charge/ Shift In-charge/ Superintendent as the case may be. The candidate should also forward along with their application a detail of the work done during the last six months in brief indicating that he has got comprehensive experience mentioning the details of the aircraft, engines and the systems and the type of schedule carried out.

9 Applications for Examinations:

- 9.1 The examination for the purpose of acquiring the AME license will be conducted normally thrice a year in the months of February, June and October. Applications for basic papers should be submitted to the Director of Airworthiness (CEO), Office of the Director General of Civil Aviation, East Block III, R.K. Puram, New Delhi – 110066 on the prescribed form CA-9 (available on DGCA's website) along with the requisite fees as per Rule 62 and required documents.
- 9.2 Applications for specific papers shall be submitted to the Regional/Sub Regional Airworthiness office on the prescribed form CA-9 (available on DGCA's website) along with the requisite fees as per Rule 62 and required documents. For this purpose the concerned Regional/ Sub-Regional Airworthiness Office shall be the one where the maintenance facility for the specific aircraft/engine/system maintenance facility is based. The applicant for specific paper shall have passed the basic subject knowledge papers/ modules in the relevant category and shall have undergone a type training course on the specific aircraft/power plant/system.
- 9.3 The AME written examination Papers I, II and III and the modules will be conducted at the designated centers namely New Delhi, Mumbai, Hyderabad, Kolkata, Kanpur, Bangalore, Chennai, Patna, Lucknow, Bhopal, Guwahati, Bhubaneswar, Ahmadabad and Cochin.
- 9.4 Specific type written examination will be conducted at the designated Regional Airworthiness Offices, namely New Delhi, Mumbai, Kolkata, Chennai, and Bangalore.

- 9.5 The applicants shall submit their applications through the Quality Manager of an organization where they are working, along with the requisite amount of fees, as prescribed in Aircraft Rule 62. The fees collected from the applicants should be forwarded through a consolidated crossed Bank Draft in the name of the PAO, DGCA, MCA, New Delhi, along with a list containing the particulars of each applicant, the papers they have applied for and the corresponding amount of fees submitted by them.
- 9.6 While forwarding the applications, the Quality Manager should ensure that the applications are duly and correctly filled in, and that the applicants meet the requirements including the experience requirements for appearing in the examinations in the papers applied for. The Quality Manager should also ensure that the applicant has gained comprehensive maintenance experience of the particular type of aircraft/ power plant/ systems.
- 9.7 The applicants, who are not engaged in any organization, but meet all the requirements for appearing in the specific paper of the AME licence examinations, may forward their applications through the Training/ Quality manager of the organization where he has undergone type training, to Director of Airworthiness of the regional office. The applicants should enclose documentary evidence of the experience gained in the category applied for.

10 Examination Results:

- 10.1 Results of each individual subject paper and each modular examination will be declared by CEO by publishing it on the DGCA Website.
- 10.2 An applicant who passes any subject paper/module shall be issued with a result card for individual papers.
- 10.3 After passing all the subject papers or modules in the related stream (Mechanical /Avionics), the applicant shall be issued with a certificate indicating that he/she has passed the relevant written knowledge examinations for that stream. The application Form and the format of the certificate is at the appendix 1. This certificate shall be issued in place of Basic AME license, issue of which has been discontinued with effect from 01 October 2009.

11 Specific Paper

The Specific paper will consist of only one written paper. This paper will contain questions pertaining to maintenance and construction, as applicable to the category of AME license to cover particular type of aircraft/ engine/system or stream.

Note 1. The applicants who have successfully completed a DGCA approved or manufacturer's training course on the particular type of aircraft / engine / systems, will be exempted from this paper.

Note 2. An applicant for specific paper examination shall have undergone a DGCA approved training course on the type of aircraft / power plant / system or stream.

Note 3. Specific Paper will be conducted by Director of Airworthiness of the concerned region. This examination shall be conducted on need basis and shall not follow the schedule of regular sessions of examinations conducted by CEO.

12 Approved Course

The type training programme of Aircraft/ Power Plant/ systems or stream consisting of theoretical and OJT, conducted by the manufacturer or training establishments approved by FAA/ EASA/ DGCA, is accepted as approved course. The approved training course conducted abroad at manufacturer's facilities or at manufacturer's approved OEM, if approved by FAA or EASA under Part 147, shall be acceptable to DGCA and an individual approval will not be required. The duration of approved training course if conducted in India by an airline shall not be less than that of manufacturer's training or OEM's training. For an approved course the pass marks are 70% for each phase and the aggregate of all the phases shall be 80%.

Note. A one off type training course may be conducted by an AMO/operator with the approval of DGCA subject to demonstrating capability with regard to approved instructors, training facilities, teaching aids, OJT programme etc. Examination for various phases of the course shall be conducted by DGCA Regional office.

13 Skill test

- 13.1 Applicants having passed specific paper or approved course of specific types of aircraft/ power plant/ systems may submit applications (CA-9) along with the requisite amount of fees through Quality Manager/Principal Training Officer to Regional Airworthiness Office who will conduct the skill test of these persons and will also declare the result accordingly.
- 13.2 This skill test will be conducted to assess the applicant's familiarization with the aircraft / power plant / system, and his skill/ competency in carrying out maintenance tasks, snag rectification, use of maintenance data, tools and equipments. The pass percentage will be 70%.

- 13.3 The skill test will be conducted in the premises of the organization by a board comprising of DGCA officers and a representative of the concerned organization. The result will be finalized and signed at the completion of the test.
- 13.4 The applicant can avail three chances of skill test within a period of 30 months from the date of passing of the specific paper or successful completion of the approved course. Additional 6 months may be allowed to candidates by the Director of Airworthiness in the Regional Office, if the request for additional time is justified.
- 13.5 The applicant, who is declared failed in the skill test, can avail the subsequent chance provided he has gained three months additional experience on the particular type of aircraft in the relevant stream.
- 13.6 Results of all Specific papers and skill test will be declared by the concerned Regional Airworthiness Office.

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P A P E R I

Aircraft Rules and Regulations

Knowledge of Aircraft Rules as far as they relate to airworthiness and safety of aircraft.

Knowledge of Privileges and responsibilities of the various categories of AME Licence and approved persons.

Knowledge of "Civil Airworthiness Requirements", "Aeronautical Information Circulars (relating to airworthiness)", "Advisory Circulars" and AME Notices issued by DGCA.

Knowledge of various mandatory documents like Certificate of Registration, Certificate of Airworthiness , Flight Manual, Export Certificate of Airworthiness.

Method of identifying approved material on Aircraft.

Knowledge of various documents/ certificates issued to establish airworthiness of Aircraft parts.

Various logbooks required to be maintained for Aircraft. Method of maintaining the logbook. Procedure for making entries in logbooks; Journey logbook, Technical logbook etc.

Use of schedules, its certification, preservation.

Stores: Bonded and Quarantine stores, storage of various aeronautical products including rubber goods, various fluids.

Knowledge of various terms such as Certificate of Flight Release, Certificate of Maintenance, Approved Certificates.

Condition under which Aircraft is required to be test flown; Certificate to be issued by AME for test flight.

Circumstances under which C of A is suspended.

Ferry Flight, MEL, CDL.

Minimum equipments, instruments required for various types of operation.

Modification, concession, Airworthiness Directive, Service Bulletins.

Approval of Organisation.

Documents required to be carried on board.

Issue of Type Approval.

Registration markings.

Human performance and limitations relevant to the duties of
an aircraft maintenance engineer licence holder.

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P A P E R II

Aircraft General Engineering And Maintenance Practices

1. Aircraft Maintenance Practices

General knowledge of procedure of jacking, leveling and mooring of aircraft .

Knowledge of maintenance and handling of equipments used in the maintenance of aircraft.

Knowledge of safety and fire precautions to be observed during maintenance, refueling and defueling of aircraft

Knowledge of colour coding ,symbols or other markings to identify fluid systems pipelines, rubber parts and other aircraft systems of aircraft .

Knowledge of various Aircraft manuals, ATA system of classification, inspection schedules, time limit.

2. Workshop Practices

Knowledge of material, parts and use of hand tools , simple machine tools and precision measuring instruments

Detailed knowledge of identification, terminology, correct use and inspection of aircraft bolts, nuts, rivets, screws and locking devices of British and American systems

Detailed knowledge of the interpretation of engineering drawings including symbols

Detailed knowledge of various types of gears and bearings, their use and common defects.

Knowledge of various forms of threads used in British and American system.

Knowledge of various types of threads, drills, taps, reamers.

Knowledge of hardness testing machines and various types of hardness numbers.

Knowledge of various types of Aircraft cables and swaging procedures used.

3. Aircraft Metallurgy

Knowledge of commonly used ferrous, nonferrous and composite materials, their identification, properties, heat treatment processes, testing and their application in aircraft industry.

Knowledge of various types of corrosion, its cause and protection.

Detailed knowledge of the hot oil and chalk, dye penetrant and fluorescent and magnetic particle techniques and the subsequent inspection of the parts.

Knowledge of the X-ray, Ultrasonic and eddy current inspections.

Knowledge of arc welding, gas welding, brazing and soldering.

4. Electrical and Instrument and Radio

Knowledge of electrical terminology and components used in AC/DC circuitry, Ohm's law, Kirchoff's law and their application. Principle of Electromagnetic Induction and their application. Various methods of voltage regulation. Principle of operation of electrical test equipments.

Knowledge of Batteries and their maintenance.

Knowledge of principle of operation of aircraft and engine instruments.

Knowledge of various types of diodes/ triodes/ transistors and their function.

Knowledge of conversion from decimal to binary system and vice-versa. Symbols used in logic gates.

Elementary knowledge of computers, its applications.

Identify the bands of frequency spectrum, their use and propagation characteristics.

5. Aircraft and Engine

Knowledge of the functions of the major aircraft components and types of propulsion systems used in aircraft industry.

Knowledge of the terms lift, drag, angle of attack, stall.

Knowledge of principle of four stroke cycle and Brayton's cycle as applied to piston engines and jet engines.

P A P E R - III

Category A : AIRFRAME (AIRCRAFT HAVING AUW BELOW 5700 KG.)

1. Aircraft Materials

Knowledge of effect of various alloying elements used in steel, properties and their use.

Knowledge of Heat treatment of Steel and Aluminium.

Knowledge of surface hardening processes used on aircraft metals.

Knowledge of welding techniques such as gas welding, arc welding, electric welding etc.

Knowledge of identification and physical characteristics of commonly used composite materials, plastics, sealants and rubbers and their inspection and repair.

Detailed knowledge of metal/ fabric materials used in aircraft structure; the types of defects associated with them; inspection for deterioration, and methods of rectification and reprotection; procedures for testing the soundness of these materials. Doping process.

Knowledge of the various methods used for removal of corrosion from common aircraft metals and methods employed to prevent corrosion.

Knowledge of types of wood and glue and their characteristics, general defects, tests, inspection and repair.

Knowledge of cables, chains and sprockets.

2. Aerodynamics

Knowledge of the characteristics of the subsonic airflow and the various terms used therein.

Knowledge of the characteristics of the aerofoils.

Knowledge of the forces acting on the Aircraft during all phases of flight.

Detailed knowledge of Aircraft Stability and Control.

Knowledge of the effect of altitude, weight, changes of engine power on performance of the aircraft.

3. Aircraft Structures

General understanding of the various types of structures used in Aircraft construction, Station Nos.

Knowledge of such terms as damage tolerance, aging Aircraft, SSID.

Knowledge of fail-safe and safe-life concept.

Knowledge of various types of methods used on tubular structure, semi-monocoque fuselage, method of attachment of wing to the fuselage; permanent and semi-permanent joints, their inspection and repair.

4. Aircraft Systems

General knowledge of the function, maintenance and inspection of the following :

- (a) Structure and structural components constructed from metal, glass fibre, glass reinforced plastic, vinyl, perspex.
- (b) Furnishing materials, paints, surface finishes and associated materials.
- (c) Elementary flying controls; hydraulics; pneumatics; landing gear; brakes; nose wheel steering; ice and rain protection; fire detection and protection, warning and extinguishing; oxygen; airconditioning and pressurization systems; wheels; tyres; brakes; antiskid.
- (d) Windows, doors and emergency exits.

5. Aircraft Instruments and Equipments

Detailed knowledge of the procedures of replacement and in-situ operational tests of all instruments (except the engine related instruments) and equipment (except where the use of special test instrument/ equipment is required.)

Knowledge of construction of various types of Direct Reading Compass, various related terms used in electricity/ magnetism, and compass swing precautions and procedures.

6. Inspection Of Aircraft

Knowledge of minor defects, their reporting, investigation and methods of rectification and repair of minor defects, rigging of aircraft, periodical inspection necessary to check the serviceability of the Aircraft, preparation of a brief report with the help of sketches if necessary in case of damage to the Aircraft. Symmetry check, Balancing of control surfaces; duplicate inspection.

Detailed knowledge of the various inspections such as heavy landing, lightning strike , overweight landing, abnormal flight loads etc.; Familiarity of the structural manuals, various types of repairs given by the manufacturer therein; incorporation of alternate/ equivalent materials; raising up of modifications, repair schemes to the aircraft during overhaul.

Knowledge of terms related to aircraft weighing, preparation/ precautions for weighing, preparation of weight schedule, calculation of centre of gravity.

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P A P E R - III

Category A : AIRFRAME (AIRCRAFT HAVING AUW 5700 KG. AND ABOVE)

1. Aircraft Materials

Knowledge of effect of various alloying elements in the structure of steel/ Aluminium, their properties and use.

Knowledge of Heat treatment of Steel and Aluminium.

Knowledge of surface hardening processes used on aircraft metals.

Knowledge of identification and physical characteristics of commonly used composite materials, plastics, sealants and rubbers and their inspection and repair.

Detailed knowledge of metallic materials used in aircraft structure; the types of defects associated with them; inspection for deterioration, and methods of rectification and reprotection; procedures for testing the soundness of these materials.

Detailed knowledge of the various types of corrosion commonly encountered on aircraft metals, their removal and methods employed to prevent corrosion.

Knowledge of use of hardness testing machines, various types of hardness no. and surfaces finishes.

2. Aerodynamics

Knowledge of the characteristics of the subsonic, transonic and supersonic airflow and the various terms used therein.

Knowledge of the characteristics of the aerofoils used for subsonic and transonic flights.

Knowledge of the forces acting on the Aircraft during all phases of flight.

Detailed knowledge of Aircraft Stability and Control.

Knowledge of the effect of altitude, weight, changes of engine power on performance of the aircraft.

Knowledge of various types of high lift and drag devices, their operation, vortex generators, boundary layer fences etc.

Knowledge of the following :

Sweepback wing; High incidence tailplane; aerodynamic loading; superstall; load factors; aquaplaning; fly by wire concept.

3. Aircraft Structures

General understanding of the various types of structures used in Aircraft construction, Station Nos.

Knowledge of fail-safe and safe-life concept.
Knowledge of such terms as damage tolerance, ageing aircraft, SSID.

4. Aircraft Systems

General knowledge of the function, maintenance and inspection of the following :

- (a) Structure and structural components constructed from metal, glass fibre, glass reinforced plastic, vinyl, perspex.
- (b) Furnishing materials, paints, surface finishes and associated materials.
- (c) Elementary flight controls including power operated/ assisted flight controls; hydraulics; pneumatics; landing gear; brakes; nose wheel steering; wheels; tyres; antiskid; ice and rain protection; fire detection and protection, warning and extinguishing; oxygen; airconditioning and pressurization systems; life saving equipment including inflatable slides, dinghies and rafts.
- (d) Windows, doors and emergency exits.

5. Aircraft Instruments and Equipments

Elementary knowledge of the operational principles of all instruments (except the engine related instruments).

Knowledge of construction of various types of Direct Reading Compass, various related terms used in electricity/ magnetism, and compass swing precautions and procedures.

6. Inspection Of Aircraft

Knowledge of minor defects and various methods of rectification and repair of minor defects, rigging of aircraft, periodical inspection necessary to check the serviceability of the Aircraft, inspection of the Aircraft after heavy

landing, lightening strike and abnormal flight loads, preparation of a brief report with the help of sketches if necessary in case of damage to the Aircraft.

Knowledge of terms related to aircraft weighing, preparation/ precaution and method of weighing the aircraft.

Knowledge of duplicate inspection of control systems.

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PAPER III
Category A : AIRFRAME (HELICOPTERS)

1. The various terms used in helicopter construction and the functioning of each component part of the Helicopter.
2. Aerodynamics and theory of flight of the helicopter and theory of flight controls.
3. Preparation of a brief report, illustrated by sketches if necessary describing the replacements required in the event of damage, defect or wear.
4. The inspection and checks for alignment after assembly of the helicopter structural components.
5. The correction of faults experienced in flight with particular reference to rigging and control settings and the inspection during and after the adjustment of flying controls.
6. General maintenance (including equipment) and minor repairs.
7. The assembly of helicopter structure, with reference to the assembly and functioning of the rotors including transmission.
8. A knowledge of the function, maintenance and inspection of helicopter structure and structural components, doors and windows; flying control systems and servo units; transmission systems including main rotor head and balancing and tracking of main and tail rotor blades; gear boxes; free-wheel units; main rotor brakes, shafts and couplings, electric, hydraulic, pneumatic and fuel systems; landing gear (including shock struts and retracting devices), wheels, tyres, brakes, ice and rain protection systems; fire warning and extinguishing systems etc.
9. A general knowledge of the inspection and checks required after heavy landings, lightning strikes and abnormal flight loads.
10. Periodic inspections necessary to check the serviceability of life saving and safety equipment.
11. A knowledge of the principles of operation, function, testing and calibration to determine serviceability of pressure, gyroscopic, simple a.c. and d.c. operated instruments, Pitot systems and automatic pilots.
12. A knowledge of, and the precautions taken during airframe maintenance, jacking, towing, braking, ground de-icing, supplying ground power, refuelling and de-fuelling etc.
13. A detailed knowledge of procedure and precautions necessary

to avoid deterioration of airframe and associated equipment
when the helicopter is out of use for extended periods.

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P A P E R - III

Category B : AIRFRAME (AIRCRAFT HAVING AUW BELOW 5700 KGS
INCLUDING ROTORCRAFT)

1. Aircraft Materials

A general knowledge of the workshop processes , welding and protective treatments.

A detailed knowledge of methods of assessment and removal of corrosion including treatment and re-protection.

Knowledge of effect of various alloying elements used in steel, properties and their use.

Detailed knowledge of Heat treatment of Steel and Aluminium.

Detailed knowledge of surface hardening processes used on aircraft metals.

Detailed knowledge of identification and physical characteristics of commonly used composite materials, plastics, sealants, fluids and rubbers and their inspection and repair.

Detailed knowledge of metallic/ fabric materials used in aircraft structure; the types of defects associated with them; inspection for deterioration, and methods of rectification and re-protection; procedures for testing the soundness of these materials.

Detailed knowledge of wooden structures and the adhesive used in them; types of defects; inspection for deterioration; methods of rectification and re-protection, Detailed knowledge of inspection to prove soundness in wooden structures and glued joints (applicable to only to aircraft having wooden structures).

2. Aerodynamics

Elementary knowledge of the subsonic airflow and the various terms used therein.

Detailed knowledge of the characteristics of the aerofoils.

Knowledge of the forces acting on the Aircraft during all phases of flight.

Knowledge of Aircraft Stability and Control.

Elementary knowledge of the effect of altitude, weight, changes of engine power on performance of the aircraft.

3. Aircraft Structures

Detailed knowledge of the various types of structures used in aircraft construction, Station Nos.

Knowledge of fail-safe and safe-life concept.

Detailed knowledge of damage tolerance, SSID, major repair.

Detailed knowledge of NDT techniques and corrosion prevention.

4. Aircraft Systems

General knowledge of the function and detailed knowledge of inspection and overhaul of the following :

- (a) Structure and structural components constructed from metal, glass fibre, glass reinforced plastic, vinyl, perspex.
- (b) Furnishing materials, paints, surface finishes and associated materials.
- (c) Flight controls; hydraulics; pneumatics; landing gear; brakes; nose wheel steering; ice and rain protection; fire detection and protection, warning and extinguishing; oxygen; airconditioning and pressurization systems; wheels; tyres; antiskid system.
- (d) Windows, doors and emergency exits.

A detailed knowledge of the procedures for the overhaul/testing of component parts of pneumatic, hydraulic, airconditioning, oxygen, anti-icing, de-icing, fire extinguishing, rotorcraft transmission system (if applicable).

5. Inspection Of Aircraft

Detailed knowledge of preparing the aircraft for complete overhaul/ inspection. Procedure of removal of main components.

A general knowledge of preparation of inspection reports prior to repair/ overhaul.

Knowledge of defect reporting, analysis, investigation and recording.

A detailed knowledge of the use of workshop inspection aids, including NDT equipments, factors and limitations effecting the choice of equipment and methods of inspection used.

A detailed knowledge of the assembly, approved repair schemes applicable to major components including engine mounting structures; inspection before, during and after repair including the alignment and symmetry checks.

A detailed knowledge of the repair, inspection and testing of water, fuel and oil tanks, heat exchanger units, fuel and oil systems and all types of control systems.

A detailed knowledge of the weighing of Aircraft and preparation of weight schedule. Terms related to Aircraft weighing and preparation of aircraft before weighing.

A detailed knowledge of the procedure for final inspection of an Aircraft after overhaul and major repair.

A detailed knowledge of the care, use and checking for accuracy of special tools.

Draft

P A P E R - III

Category C : PISTON ENGINES AND PROPELLERS
(Unsupercharged and Supercharged)

1. Piston Engine Theory and Construction

A general knowledge of thermodynamic laws related to internal combustion engines.

Knowledge of heat engines.

General knowledge of the Otto cycle and the relationship between volume, temperature and pressure.

A general knowledge of the terms used in the theory of piston engines and calculations of parameters from the given data.

Knowledge of various efficiencies involved in internal combustion engines.

Differences between two stroke and four stroke engines.

Knowledge of the function, construction, classification and material of the various parts and accessories of the engine including the induction, exhaust, cooling systems and engine mounting.

A general understanding of the propeller terms.

A general knowledge of the purpose and functioning of all parts of a constant speed, variable pitch and feathering propeller and their associated control system components.

Knowledge of the various factors effecting the engine performance.

Knowledge of the engine fire detection and protection systems.

2. Engine Fuel and Oil System

Knowledge of the principle of operation and constructional features of carburetors.

Knowledge of the constructional features and function of components of engine fuel system.

Knowledge of types, characteristics of aviation fuel, common

sources of contamination and methods to prevent such contamination. Method of checking for contamination.

Knowledge of types, characteristics of lubricants used in piston engine oil system. Contamination of oil and its identification.

Knowledge of various components of oil system.

3. Ignition and Starting System

Knowledge of principle of operation, constructional features and function of magnetos and ignition system components. Magneto timing procedure.

Knowledge of principle of operation, constructional features and function of various types of engine starters.

4. Engine Instruments

Knowledge of the principle of operation of the engine instruments, and detailed knowledge of replacement and in-situ operational tests thereof.

5. Supercharged System

Knowledge of principle of operation, constructional features and function of various types of superchargers and its related components/ parts.

6. Engine Maintenance

Knowledge of trouble shooting of minor defects and methods of their rectification; rigging of engine controls; periodical inspections necessary to check the serviceability of the engine; inspection after propeller strike.

Detailed knowledge of engine starting; ground run-up; adjustments and checking of the performance of the engine and its components including systems; Top overhaul procedure and engine on-condition maintenance.

Knowledge of NDT techniques as applicable to engine parts.

Knowledge of engine preservation and depreservation procedures.

P A P E R - III

Category C : TURBINE ENGINES AND VARIABLE PITCH PROPELLERS

1. Gas Turbine Engine Theory and Construction

A general knowledge of the thermodynamics laws related to gas turbine engines.

General knowledge of the Otto Cycle and Brayton's Cycle and the relationship between volume, temperature and pressure.

A general knowledge of the terms used in the theory of gas turbine engines and calculations of parameters from the given data.

Advantages and Disadvantages of various types of gas turbine engines.

Knowledge of the function, construction, classification and material of the various parts and accessories of the engine including the induction, exhaust, cooling systems, thrust augmentation and engine mounting, antiicing of engine.

Knowledge of the various factors effecting the engine performance.

Knowledge of condition monitoring and performance monitoring of gas turbine engines.

Detailed knowledge of the engine fire detection and protection systems.

2. Engine Fuel and Oil System

Knowledge of the principle of operation and constructional features of fuel control units.

Knowledge of constructional features, function of the components of engine fuel control system/ metering system.

Knowledge of types, characteristics of aviation fuel, common sources of contamination and methods to prevent such contamination. Method to check contamination with precautions.

Knowledge of types, characteristics of lubricants used in gas turbine engine lubrication system. Identification of contaminants with inference drawn.

Detailed knowledge of function of various components of lubrication system.

3. Ignition and Starting System

Knowledge of principle of operation, constructional features and function of ignition system components. Types of ignition; flame propagation.

Knowledge of constructional features and function of various types of engine starters.

4. Engine Instruments

Knowledge of the principle of operation of the engine instruments, and detailed knowledge of replacement and in-situ operational tests thereof.

5. Power Augmentation System

Knowledge of principle of operation and function of various types of power augmentation devices.

6. Propeller

A general understanding of the propeller terms.

A general knowledge of the purpose and function of all parts of a constant speed, variable pitch and feathering propeller and their associated control system components.

7. Thrust Reversers

Knowledge of constructional features and function of various types of thrust reversers and their related components.

8. Auxiliary Power Unit

General knowledge of the purpose, constructional features of compressors, combustion chambers and turbine arrangement; speed and load control; limiting factors; fire protection and indication; detailed knowledge of its operational features.

9. Bleed Control System

Terms related to bleeding of air from the engine; compressor surge; compressor line; compressor stall; Bleed loads and condition under which bleed is tapped.

10. Air Oil System

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

11. Engine Maintenance

Knowledge of trouble shooting of minor defects and methods of their rectification; rigging of engine controls and field adjustments of fuel control unit; periodical inspections necessary to check the serviceability of the engine; special inspection schedules; duplicate inspection of engine controls.

Detailed knowledge of engine starting; ground run-up; trimming; and checking of the performance of the engine and its components including systems.

Knowledge of engine preservation and depreservation procedures.

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PAPER III

Category E : Electrical Systems

1. Electrical Theory

Detailed knowledge of Ohms law, Kirchoff's laws and Electro-magnetic Induction; their applicability in the aircraft industry.

Detailed knowledge of the Alternating Current and calculation of Instantaneous value, RMS value, frequency and amplitude from the given data; star and delta connections and calculation of power in three phase system.

Detailed knowledge of series and parallel resonance of AC circuits and their use; calculation of resonant frequency of a circuit from a given information; effect of change in the frequency on the impedance, current and phase angle.

Detailed knowledge of the composition, performance (stability and tolerance) and limitations of the fixed resistors (carbon composition, carbon film, wire wound and metallic film) and description of various types of variable resistors (wire wound, carbon film, thermistors and voltage dependent resistors and varistors).

Knowledge of the resistor colour codes, value and tolerance, and the system of preferred values and wattage ratings.

Detailed knowledge of the construction, principles of operation, application and colour coding of various types of capacitors.

Detailed knowledge of Circuit Controlling and Current Protection Devices.

2. Aircraft Batteries

Knowledge of the construction and principle of operation of Lead acid and Nickel Cadmium batteries, composition of electrolytes and plates.

Knowledge of the effect of temperature on capacity, specific gravity, electrolyte resistivity, charger and discharger rates; effect of specific gravity on freezing temperature and resistivity of electrolytes.

Knowledge of methods of charging of batteries; precautions and procedures during charging; mixing and neutralization of

electrolytes; importance of ventilation of battery compartments.

Knowledge of the inspections to determine conditions and serviceability of batteries; common battery defects and their rectification.

3. Generators and Motors

Knowledge of the construction, principle of operation and characteristics of DC and AC Generators and Motors.

Knowledge of the construction, principles of operation of voltage regulators; and paralleling of generators.

Detailed knowledge of the functional tests, adjustments and trouble shooting of generators and motors.

Knowledge of speed control and reversing the direction of motors.

4. Servomechanisms and Amplifiers

Knowledge of construction and principles of autotransformers, single and three phase transformers

Knowledge of construction and principles of operation of saturable reactors and magnetic amplifiers; bias; phase sensitive half wave and inputs and outputs, polarity sensitive inputs and outputs, pushpull outputs and effects of stage gains and cascading on time response.

Knowledge of construction, principle and operation of servomotors and rate generators; system response to displacement (position) and rate (velocity) command signals; purpose of pullup and rate feedback signals; causes of hunting and methods of damping; troubleshooting of servomechanism.

5. Test Equipment

Knowledge of the construction, principle of operation, use and precautions to be observed for aircraft test equipments.

6. Bonding and Screening

Knowledge of purpose of bonding and shielding and difference between the two, precaution, methods employed; minimum acceptable standards for insulation and bonding; and testing.

Detail knowledge of aircraft wiring system; procedure of laying of electrical cables and precautions to be taken

thereof.

7. Electronics

Knowledge of the basic principles of thermionics.

Knowledge of properties of semiconductor materials.

Knowledge of construction, symbols, operation and anode characteristics of vacuum and gas-filled tubes; knowledge of their construction and application.

Knowledge of construction, symbols, doping process, operation, application and characteristics of PNP and NPN transistors; comparison with vacuum tubes.

Knowledge of use and theory of oscillators and multivibrators.

Knowledge of symbols, truth tables and equivalent circuits for logic gates.

Knowledge of the terms, operation and application of Flip Flop logic.

Knowledge of the terms used, basic operation, interfacing of the major components of a Computer.

Knowledge of operation, use and types of Medium Scale Integration (MSI) Devices.

Knowledge of the types and operation of displays (LED, Liquid crystal etc.).

Knowledge of CRTs and its application.

Knowledge of functions performed and overall operation of a microprocessor.

Knowledge of handling of microelectronic circuit devices (Electrostatic Sensitive Devices (ESD)).

8. Aircraft System

Knowledge of principle of operation, inspection and trouble shooting of aircraft galley equipments, aircraft lights, and electrical components and indicating circuits for Landing Gear, Flap System and Airconditioning system etc.

Knowledge of operation and inspection of Aircraft Fire and Smoke Detection and Protection System.

9. Power Distribution

Knowledge of electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units.

Draft

P A P E R III

Category I : AIRCRAFT INSTRUMENTS

1. Terminology and Conversion

Knowledge of the general Instrument terminology; conversions of measuring units from one system to another.

2. General Concepts

Knowledge of the atmosphere.

Knowledge of fundamentals of electricity.

Knowledge of principle of operation and characteristics of DC and AC Generators and Motors; and speed control and reversing the direction of motors.

Knowledge of principle of operation of transformers and amplifiers.

Detailed knowledge of the construction, principle of operation of servomotors and rate generators and system response to displacement (position) and rate (velocity) command

signals; purpose of pullup and feedback signals; causes of hunting and methods of damping; troubleshooting of servo-mechanisms.

Knowledge of basic principle of thermionics and properties of semi-conductor materials.

Knowledge of symbols, truth tables and equivalent circuits for logic gates.

Knowledge of the terms used, basic operation and interfacing of major components of computer.

Knowledge of the types and operation of displays (LED, Liquid Crystal etc.).

Knowledge of CRTs and its application.

Knowledge of functions performed and overall operation of a microprocessor.

Knowledge of handling of microelectronic circuit devices (Electrostatic Sensitive Devices (ESD)).

General understanding of the terms relating to Theory of

Flight : Longitudinal Axis, Lateral Axis and Vertical Axis, Yawing, Rolling, Pitching, Azimuth Heading, Course, sideslip, skidding, Coordinated turn, Stability, angle of attack, chord, stall, lift, drag, thrust.
General knowledge of the purpose and action of primary control surfaces, trim tabs and wing flaps.

Knowledge of the principle of operation, construction and characteristics of pressure sensitive and temperature sensitive elements.

Knowledge of the principle of operation, constructional features and characteristics of Gyroscopes.

3. Aircraft Instruments and systems

Knowledge of principle of operation and construction; detailed knowledge of procedures of replacement, field maintenance, functional testing and trouble shooting of :

Altimeters, Airspeed Indicators, Vertical Speed Indicators, pitot heads, pitot static lines, static selectors and moisture traps;

Air Driven Gyros, Artificial Horizons and Turn and Bank Indicators;

Venturi tubes, vacuum pumps, relief valves, regulators, check valves and filters;

Turn and Bank indicators operated by direct gauges;

Capillary tube type pressure and temperature gauges;

Position Indicators operated by Direct Current;

Fluid Quantity Indicators operated by Direct current and Capacitors;

Wheatstone bridge; ratiometer and thermocouple type tempera-

ture Indicators;

Three Phase engine rpm indicators and synchrosopes;

Centrifugal governor type and magnetic drag-cup type engine rpm indicators;

Direct reading and remote reading compasses;

AC operated gyro instruments;

AC synchro instruments.

4. Autopilot System

Knowledge of function and operation of components in a typical Autopilot system; responses of the system in flight and during functional checks on ground.

5. Oxygen System

Knowledge of function, layout and features of components of typical oxygen system; and detailed knowledge of the replacement procedures and safety precautions to be observed.

6. Inertial Navigation System

Knowledge of principle of operation and function of the components of Inertial Navigation System.

7. Satellite Communication

Elementary principle of satellite Communication and its application to aircraft.

Draft

PAPER III

Category R : COMMUNICATION SYSTEMS - RADIO BASICS (Maintenance)

General knowledge of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests.

Detailed knowledge of the Alternating Current and calculation of Instantaneous value, RMS value, frequency and amplitude from the given data; star and delta connections and calculation of power in three phase system.

Detailed knowledge of series and parallel resonance of AC circuits and their use; calculation of resonant frequency of a circuit from a given information; effect of change in the frequency on the impedance, current and phase angle.

Detailed knowledge of the composition, performance (stability and tolerance) and limitations of the fixed resistors (carbon composition, carbon film, wire wound and metallic film) and description of various types of variable resistors (wire wound, carbon film, thermistors and voltage dependent resistors and varistors).

Construction and functioning of small AC and DC motors and generators.

Knowledge of series and parallel circuits, filters, impedance matching circuits, resonance, series and parallel resonant circuits, Q factor, Bandwidth.

Detailed knowledge of AC and DC measuring instruments.

Detailed knowledge of thermionics emission; constructional features, application, limitations and functioning of thermionic valves.

Detailed knowledge of materials, application and properties of semi-conductors.

Knowledge of construction, symbols, doping process, operation, application and characteristics of PNP and NPN transistors; comparison with vacuum tubes.

Knowledge of construction, symbols, operation and anode characteristics of vacuum and gas-filled tubes; knowledge of their construction and application.

Knowledge of construction and principles of autotransformers, single and three phase transformers

**CIVIL AVIATION REQUIREMENTS
SERIES 'L' PART II**

**SECTION 2-AIRWORTHINESS
01 SEPTEMBER 2009**

Knowledge of construction and principles of operation of saturable reactors and magnetic amplifiers; bias; phase sensitive half wave and inputs and outputs, polarity sensitive inputs and outputs, pushpull outputs and effects of stage gains and cascading on time response.

Knowledge of use and theory of oscillators and multivibrators.

Knowledge of symbols, truth tables and equivalent circuits for logic gates.

Knowledge of the terms, operation and application of Flip Flop logic.

Knowledge of the terms used, basic operation, interfacing of the major components of a Computer.

Knowledge of operation, use and types of Medium Scale Integration (MSI) Devices.

Knowledge of the types and operation of displays (LED, Liquid crystal etc.).

Knowledge of CRTs and its application in aviation.

Knowledge of functions performed and overall operation of a microprocessor.

Knowledge of handling of microelectronic circuit devices (Electrostatic Sensitive Devices (ESD)).

Knowledge of electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units.

Knowledge of modulation and demodulation, amplitude, frequency and phase modulation, AM and FM receivers, transmitter, superheterodyne principle; balanced modulator.

Detailed knowledge of radio frequency transmission lines, coaxial cables, current and voltage distribution, impedance of lines, standing waves, standing wave ratio, matching, tuning stubs, waveguides, attenuation in waveguides, resonant cavities.

Knowledge of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.

Knowledge of identification, use, propagation characteristics and identification of the band spectrum.

Knowledge of terms connected with, construction and identification for various types of antennas; the voltage and

current distribution along antenna of various length; characteristics of ground planes.

Knowledge of very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate ranges of communication (line of sight) with given data.

Knowledge of the performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers.

Knowledge of the theory of operation, performance level and specifications of an Audio Integration System.

Knowledge of working principles and testing of Lead Acid and Nickel Cadmium batteries.

Knowledge of method, purpose, chemical combination, flux used, tinning for Soldering.

Knowledge of Bonding and Screening.

Knowledge of terms used, principle, operation, characteristics, installation and maintenance:

Automatic Direction Finder (ADF) Systems.

Very High Frequency (VHF) Omni Directional Range System

Instrument Landing Systems

Weather Radar Systems.

Microwave Devices.

Air Traffic Control (ATC) Transponder System.

Very Low Frequency (VLF) Navigation Systems (WH).

Omega Navigation System.

Radio Altimeter Systems

Cockpit Voice Recorder

Distance Measuring Equipment

Doppler Navigation System

Microwave Landing System

Ground Proximity Working Systems.

Emergency Locator Transmitters

Knowledge of Principle of Satellite Communication and its application to aircraft.

Draft

MODULE WISE SYLLABUS OF DGCA AME LICENCE EXAMINATION

Module 1 Air Law, Airworthiness Requirements

- Aircraft Manual
- Civil Aviation Requirements (Section 2- Airworthiness)
- Aeronautical Information Circulars (relating to Airworthiness)
- Airworthiness Advisory Circulars
- Aircraft Maintenance Engineers' Notices

Draft

Module 2 - HUMAN PERFORMANCE

1. General

CIVIL AVIATION REQUIREMENTS

SECTION 2-AIRWORTHINESS

SERIES 1 - PART II

01 SEPTEMBER 2009

- The requirements make human factors into account;
- Incidents attributable to human factors/human error;
 - 'Murphy's' law.

2. Human Performance and Limitations

- Vision;
- Hearing;
- Information processing;
- Attention and perception;
- Memory;
- Claustrophobia and physical access.

3. Social Psychology

- Responsibility: individual and group;
- Motivation and de-motivation;
- Peer pressure;
- 'Culture' issues;
- Team working;
- Management, supervision and leadership.

4. Factors Affecting Performance

- Fitness/health;
- Stress: domestic and work related;
- Time pressure and deadlines;
- Workload: overload and underload;
- Sleep and fatigue, shiftwork;
- Alcohol, medication, drug abuse.

5 Physical Environment

- Noise and fumes;
- Illumination;
- Climate and temperature;
- Motion and vibration;
- Working environment.

6 Tasks

- Physical work;
- Repetitive tasks;
- Visual inspection;
- Complex systems.

7 Communication

- Within and between teams;
- Work logging and recording;
- Keeping up to date, currency;

Module 3 - MAINTENANCE PRACTICES	
1. Safety Precautions-Aircraft and Workshop	<ul style="list-style-type: none">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.
2. Workshop Practices	<ul style="list-style-type: none">Care of tools, control of tools, use of workshop materials;Dimensions, allowances and tolerances, standards of workmanship;Calibration of tools and equipment, calibration standards.
3. Tools	<ul style="list-style-type: none">Common hand tool types; Common power tool types; Operation and use of precision measuring tools; Lubrication equipment and methods.Operation, function and use of electrical general test equipment.
4. Avionic General Test Equipment	<ul style="list-style-type: none">Operation, function and use of avionic general test equipment.
5. Engineering Drawings, Diagrams and Standards	<ul style="list-style-type: none">Drawing types and diagrams, their symbols, dimensions, tolerances and projections;Identifying title block information;Microfilm, microfiche and computerised presentations;Specification 100 of the Air Transport Association (ATA) of America;Aeronautical and other applicable standards including ISO, AN, MS, NAS and MIL;

<ul style="list-style-type: none">• Wiring diagrams and schematic diagrams.
6. Fits and Clearances <ul style="list-style-type: none">• 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.
7. Electrical Cables and Connectors <ul style="list-style-type: none">• Continuity, insulation and bonding techniques and testing;• Use of crimp tools: hand and hydraulic operated; Testing of crimp joints;• Connector pin removal and insertion; Co-axial cables: testing and installation precautions;• Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques, including heat shrink wrapping, shielding.
8. Riveting <ul style="list-style-type: none">• Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling;• Inspection of riveted joints.
9. Pipes and Hoses <ul style="list-style-type: none">• Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.
10. Springs <ul style="list-style-type: none">• Inspection and testing of springs.
11. Bearings <ul style="list-style-type: none">• Testing, cleaning and inspection of bearings; Lubrication requirements of bearings;• Defects in bearings and their causes.• 28.11.2003 L 315/100 Official Journal of the European Union EN
12. Transmissions <ul style="list-style-type: none">• Inspection of gears, backlash;• Inspection of belts and pulleys, chains and sprockets;• Inspection of screw jacks, lever devices, push-pull rod systems.
13. Control Cables <ul style="list-style-type: none">• Swaging of end fittings; Inspection and testing of control cables;• Bowden cables; aircraft flexible control systems.
14 Material handling
14.1 Sheet Metal <ul style="list-style-type: none">• Marking out and calculation of bend allowance;• Sheet metal working, including bending and forming; Inspection of sheet metal work.
14.2 Composite and non-metallic <ul style="list-style-type: none">• Bonding practices; Environmental conditions; Inspection methods

15. Welding, Brazing, Soldering and Bonding

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

16. Aircraft Weight and Balance

- (a) Centre of Gravity/Balance limits calculation: use of relevant documents;
- (b) Preparation of aircraft for weighing; Aircraft weighing.

17. Aircraft Handling and Storage

- Aircraft taxiing/towing and associated safety precautions;
- Aircraft jacking, chocking, securing and associated safety precautions;
- Aircraft storage methods;
- Refuelling/defuelling procedures;
- De-icing/anti-icing procedures;
- Electrical, hydraulic and pneumatic ground supplies.
- Effects of environmental conditions on aircraft handling and operation.

18. Disassembly, Inspection, Repair and Assembly Techniques

- (a) Types of defects and visual inspection techniques.
Corrosion removal, assessment and re-protection.
- (b) General repair methods, Structural Repair Manual;
Ageing, fatigue and corrosion control programmes;
- (c) Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods.
- (d) Disassembly and re-assembly techniques.
- (e) Trouble shooting techniques

19. Abnormal Events

- (a) Inspections following lightning strikes and HIRF penetration.
- (b) Inspections following abnormal events such as heavy landings and flight through turbulence.

20. 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

Draft

Module 4 - MATERIALS AND HARDWARE
<p>1. Aircraft Materials — Ferrous</p> <p>(a) Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels;</p> <p>(b) Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.</p>
<p>2. Aircraft Materials — Non-Ferrous</p> <p>(a) Characteristics, properties and identification of common non-ferrous materials used in aircraft; Heat treatment and application of non-ferrous materials.</p> <p>(b) Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.</p>
<p>3. Aircraft Materials — Composite and Non-Metallic</p> <p>3.1 Composite and non-metallic other than wood and fabric</p> <p>(a) Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents.</p> <p>(b) The detection of defects/deterioration in composite and non-metallic material. Repair of composite and non-metallic material.</p>
<p>4. Corrosion</p> <p>(a) Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;</p> <p>(b) Types of corrosion and their identification;</p> <ul style="list-style-type: none">• Causes of corrosion; Material types, susceptibility to corrosion.
<p>5. Fasteners</p> <p>5.1 Screw threads</p> <ul style="list-style-type: none">• Screw nomenclature;• Thread forms, dimensions and tolerances for standard threads used in aircraft;• Measuring screw threads;
<p>5.2 Bolts, studs and screws</p> <ul style="list-style-type: none">• Bolt types: specification, identification and marking of aircraft bolts, international standards;

<ul style="list-style-type: none">• Nuts: self locking, anchor, standard types;• Machine screws: aircraft specifications; Studs: types and uses, insertion and removal;• Self tapping screws, dowels.
5.3 Locking devices <ul style="list-style-type: none">• Tab and spring washers, locking plates, split pins, pal-nuts, wire locking, quick release fasteners, keys, circlips, cotter pins.
5.4 Aircraft rivets <ul style="list-style-type: none">• Types of solid and blind rivets: specifications and identification, heat treatment.
6. Pipes and Unions (a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft; (b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.
7. Springs: Types of springs, materials, characteristics and applications.
8. Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.
9. Transmissions <ul style="list-style-type: none">• 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.
10. Control Cables <ul style="list-style-type: none">• Types of cables; End fittings, turnbuckles and compensation devices;• Pulleys and cable system components; Bowden cables;• Aircraft flexible control systems.
11. Electrical Cables and Connectors <ul style="list-style-type: none">• 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.

Module 5 - ELECTRICAL FUNDAMENTALS
<p>1. Electron Theory</p> <ul style="list-style-type: none">• Structure and distribution of electrical charges within: atoms, molecules, ions, compounds;• Molecular structure of conductors, semiconductors and insulators.
<p>2. Static Electricity and Conduction</p> <ul style="list-style-type: none">• 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.
<p>3. Electrical Terminology</p> <ul style="list-style-type: none">• The following terms, their units and factors affecting them: --- potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow.
<p>4. Generation of Electricity</p> <ul style="list-style-type: none">• Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.
<p>5. DC Sources of Electricity</p> <ul style="list-style-type: none">• 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.
<p>6 DC Circuits</p> <ul style="list-style-type: none">• Ohms Law, Kirchoff's Voltage and Current Laws;• Calculations using the above laws to find resistance, voltage and current;• Significance of the internal resistance of a supply.
<p>7. Resistance/Resistor</p> <p>(a) Resistance and affecting factors;</p> <ul style="list-style-type: none">• Specific resistance;• Resistor colour code, values and tolerances, preferred values, wattage ratings;• Resistors in series and parallel;• Calculation of total resistance using series, parallel and series parallel combinations;• Operation and use of potentiometers and rheostats;• Operation of Wheatstone Bridge. <p>(b) Positive and negative temperature coefficient conductance;</p>

<ul style="list-style-type: none">• Fixed resistors, stability, tolerance and limitations, methods of construction;• Variable resistors, thermistors, voltage dependent resistors;• Construction of potentiometers and rheostats;• Construction of Wheatstone Bridge;
<p>8. Power</p> <ul style="list-style-type: none">• Power, work and energy (kinetic and potential);• Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy
<p>9 Capacitance/Capacitor</p> <ul style="list-style-type: none">• Operation and function of a capacitor;• Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating;• Capacitor types, construction and function; Capacitor colour coding;• Calculations of capacitance and voltage in series and parallel circuits;• Exponential charge and discharge of a capacitor, time constants;• Testing of capacitors.
<p>10 Magnetism</p> <p>(a) Theory of magnetism; Properties of a magnet; Action of a magnet suspended in the Earth's magnetic field; Magnetisation and demagnetisation; Magnetic shielding; Various types of magnetic material; Electromagnets construction and principles of operation; Hand clasp rules to determine: magnetic field around current carrying conductor.</p> <p>(b) Magnetomotive force, field strength, magnetic flux density, permeability, hysteresis loop, retentivity, coercive force, reluctance, saturation point, eddy currents; Precautions for care and storage of magnets.</p>
<p>11. Inductance/Inductor</p> <ul style="list-style-type: none">• Faraday's Law;• Action of inducing a voltage in a conductor moving in a magnetic field; Induction principles;• Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductor turns;• Mutual induction; The effect the rate of change of primary current and mutual inductance has on induced voltage; Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other;• Lenz's Law and polarity determining rules;• Back emf, self induction;• Saturation point;• Principle uses of inductors;

<p>12. DC Motor/Generator</p> <ul style="list-style-type: none">• Basic motor and generator theory;• Construction and purpose of components in DC generator;• Operation of, and factors affecting output and direction of current flow in DC generators;• Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors;• Series wound, shunt wound and compound motors;• Starter Generator construction.
<p>13 AC Theory</p> <ul style="list-style-type: none">• Sinusoidal waveform: phase, period, frequency, cycle;• Instantaneous, average, root mean square, peak, peak to peak current values and calculations of these values, in relation to voltage, current and power• Triangular/Square waves;• Single/3 phase principles.
<p>14 Resistive (R), Capacitive (C) and Inductive (L) Circuits</p> <ul style="list-style-type: none">• Phase relationship of voltage and current in L, C and R circuits, parallel, series and series parallel;• Power dissipation in L, C and R circuits;• Impedance, phase angle, power factor and current calculations;• True power, apparent power and reactive power calculations.
<p>15 Transformers</p> <ul style="list-style-type: none">• Transformer construction principles and operation;• Transformer losses and methods for overcoming them;• Transformer action under load and no-load conditions;• Power transfer, efficiency, polarity markings;• Calculation of line and phase voltages and currents;• Calculation of power in a three phase system;• Primary and Secondary current, voltage, turns ratio, power, efficiency;• Auto transformers.
<p>16 Filters</p> <ul style="list-style-type: none">• Operation, application and uses of the following filters:• low pass, high pass, band pass, band stop.
<p>17 AC Generators</p> <ul style="list-style-type: none">• Rotation of loop in a magnetic field and waveform produced;• Operation and construction of revolving armature and revolving field type AC generators;

- Single phase, two phase and three phase alternators;
- Three phase star and delta connections advantages and uses;
- Permanent Magnet Generators.

18 AC Motors

- Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphase
- Methods of speed control and direction of rotation;
- Methods of producing a rotating field: capacitor, inductor, shaded or split pole.

Draft

Module 6 ELECTRONIC FUNDAMENTALS

1 Semiconductors/Diodes

.2 Transistors

(a)

- Transistor symbols;
- Component description and orientation;
- Transistor characteristics and properties.

(b)

- Construction and operation of PNP and NPN transistors;
- Base, collector and emitter configurations;
- Testing of transistors.
- Basic appreciation of other transistor types and their uses.
- Application of transistors: classes of amplifier (A, B, C);
- Simple circuits including: bias, decoupling, feedback and stabilisation;

Multistage circuit principles: cascades, push-pull, oscillators
multivibrators, flip-flop circuits.

3 Integrated Circuits

(a)

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

(b)

- 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.

2 Printed Circuit Boards

- Description and use of printed circuit boards.

3 Servomechanisms

(a)

- Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers;
- Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, transformers, inductance and capacitance transmitters.

(b)

- Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, deadband;
- Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, synchronous transmitters;
- Servomechanism defects, reversal of synchro leads, hunting.

Draft

Module 7 DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS
<p>1 Electronic Instrument Systems</p> <ul style="list-style-type: none">• Typical systems arrangements and cockpit layout of electronic instrument systems.
<p>2 Numbering Systems</p> <ul style="list-style-type: none">• Numbering systems: binary, octal and hexadecimal;• Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.
<p>3 Data Conversion</p> <ul style="list-style-type: none">• Analogue Data, Digital Data;• Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types.
<p>4 Data Buses</p> <ul style="list-style-type: none">• Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.
<p>5 Logic Circuits</p> <p>(a)</p> <ul style="list-style-type: none">• Identification of common logic gate symbols, tables and equivalent circuits;• Applications used for aircraft systems, schematic diagrams. <p>(b)</p> <ul style="list-style-type: none">• Interpretation of logic diagrams.
<p>6 Basic Computer Structure</p> <p>(a)</p> <ul style="list-style-type: none">• Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memory devices such as RAM, ROM, PROM);• Computer technology (as applied in aircraft systems). <p>(b)</p> <ul style="list-style-type: none">• Computer related terminology;• Operation, layout and interface of the major components in a micro computer including their associated bus systems;• Information contained in single and multi address instruction words;

- Memory associated terms; Operation of typical memory devices;
- Operation, advantages and disadvantages of the various data storage systems.

7 Microprocessors

- Functions performed and overall operation of a microprocessor;
- Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

8 Integrated Circuits

- Operation and use of encoders and decoders;
- Function of encoder types;
- Uses of medium, large and very large scale integration.

9 Multiplexing

- Operation, application and identification in logic diagrams of multiplexers and demultiplexers.

10 Fibre Optics

- Advantages and disadvantages of fibre optic data transmission over electrical wire propagation;
- Fibre optic data bus;
- Fibre optic related terms;
- Terminations;
- Couplers, control terminals, remote terminals;
- Application of fibre optics in aircraft systems.

11 Electronic Displays

- Principles of operation of common types of displays used in modern aircraft, including Cathode Ray Tubes, Light Emitting Diodes and Liquid Crystal Display.

12 Electrostatic Sensitive Devices

- Special handling of components sensitive to electrostatic discharges;
- Awareness of risks and possible damage, component and personnel anti-static protection devices.

13 Software Management Control

- Awareness of restrictions, airworthiness requirements and

possible catastrophic effects of unapproved changes to software programmes.

14 Electromagnetic Environment

- Influence of the following phenomena on maintenance practices for electronic system:
- EMC-Electromagnetic Compatibility EMI-Electromagnetic Interference HIRF-High Intensity Radiated Field Lightning/lightning protection

15 Typical Electronic/Digital Aircraft Systems

- General arrangement of typical electronic/digital aircraft systems and associated BITE(Built In Test Equipment) testing such as:
 - ACARS-ARINC Communication and Addressing and Reporting System
 - ECAM-Electronic Centralised Aircraft Monitoring
 - EFIS-Electronic Flight Instrument System
 - EICAS-Engine Indication and Crew Alerting System
 - FBW-Fly by Wire
 - FMS-Flight Management System
 - GPS-Global Positioning System
 - IRS-Inertial Reference System
 - TCAS-Traffic Alert Collision Avoidance System

Draft

Module 8 BASIC AERODYNAMICS
1 Physics of the Atmosphere <ul style="list-style-type: none">• International Standard Atmosphere (ISA), application to aerodynamics
2 Aerodynamics <ul style="list-style-type: none">• Airflow around a body;• Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation;• The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure,• angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio;• Thrust, Weight, Aerodynamic Resultant;• Generation of Lift and Drag: Angle of Attack, Lift coefficient , Drag coefficient, polar curve, stall;• Aerofoil contamination including ice, snow, frost.
3 Theory of Flight <ul style="list-style-type: none">• 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.
4 Flight Stability and Dynamics <ul style="list-style-type: none">• Longitudinal, lateral and directional stability (active and passive).

Module 9 TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS
<p>1 Theory of Flight</p> <p>1.1 <i>Aeroplane Aerodynamics and Flight Controls</i> Operation and effect of:</p> <ul style="list-style-type: none">• roll control: ailerons and spoilers;• pitch control: elevators, stabilators, variable incidence stabilisers 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; <p>Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;</p>
<p>1.2 <i>High Speed Flight</i></p> <ul style="list-style-type: none">• 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.
<p>2 Airframe Structures — General Concepts</p> <p>(a)</p> <ul style="list-style-type: none">• 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 <p>(b)</p> <ul style="list-style-type: none">• Construction methods of: 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, anodising, painting;• Surface cleaning.• Airframe symmetry: methods of alignment and symmetry checks.

<p>3 Airframe Structures — Aeroplanes</p> <p>3.1 <i>Fuselage</i></p> <ul style="list-style-type: none">• Construction and pressurisation sealing;• Wing, stabiliser, pylon and undercarriage attachments;• Seat installation and cargo loading system;• Doors and emergency exits: construction, mechanisms, operation and safety devices;• Windows and windscreen construction and mechanisms.
<p>3.2 <i>Wings</i></p> <ul style="list-style-type: none">• Construction;• Fuel storage;• Landing gear, pylon, control surface and high lift/drag attachments.
<p>3.3 <i>Stabilisers</i></p> <ul style="list-style-type: none">• Construction;• Control surface attachment.
<p>3.4 <i>Flight Control Surfaces</i></p> <ul style="list-style-type: none">• Construction and attachment;• Balancing — mass and aerodynamic.
<p>3.5 <i>Nacelles/Pylons</i></p> <ul style="list-style-type: none">• Construction;• Firewalls;• Engine mounts.
<p>4 Air Conditioning and Cabin Pressurisation</p> <p>4.1 <i>Air supply</i></p> <ul style="list-style-type: none">• Sources of air supply including engine bleed, APU and ground cart
<p>4.2 <i>Air Conditioning</i></p> <ul style="list-style-type: none">• Air conditioning systems;• Air cycle and vapour cycle machines;• Distribution systems;• Flow, temperature and humidity control system.
<p>4.3 <i>Pressurisation</i></p> <ul style="list-style-type: none">• Pressurisation systems;• Control and indication including control and safety valves;• Cabin pressure controllers.
<p>4.4 <i>Safety and warning devices</i></p> <ul style="list-style-type: none">• Protection and warning devices.

<p>5 Instruments/Avionic Systems</p> <p>5.1 <i>Instrument Systems</i></p> <ul style="list-style-type: none">• Pitot static: altimeter, air speed indicator, vertical speed indicator;• Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator;• Compasses: direct reading, remote reading;• Angle of attack indication, stall warning systems;• Other aircraft system indication.
<p>5.2 <i>Avionic Systems</i></p> <ul style="list-style-type: none">• Fundamentals of system lay-outs and operation of;• Auto Flight (ATA 22);• Communications (ATA 23);• Navigation Systems (ATA 34).
<p>6 Electrical Power (ATA 24)</p> <ul style="list-style-type: none">• Batteries Installation and Operation;• DC power generation;• AC power generation;• Emergency power generation;• Voltage regulation;• Power distribution;• Inverters, transformers, rectifiers;• Circuit protection.• External/Ground power;
<p>7 Equipment and Furnishings (ATA 25)</p> <p>(a) Emergency equipment requirements;</p> <ul style="list-style-type: none">• Seats, harnesses and belts. <p>(b) Cabin lay-out;</p> <ul style="list-style-type: none">• Equipment lay-out;• Cabin Furnishing Installation;• Cabin entertainment equipment;• Galley installation;• Cargo handling and retention equipment;• Airstairs.
<p>8 Fire Protection (ATA 26)</p> <p>(a)</p> <ul style="list-style-type: none">• Fire and smoke detection and warning systems;• Fire extinguishing systems;• System tests.

(b)
<ul style="list-style-type: none">• Portable fire extinguisher
9 Flight Controls (ATA 27) <ul style="list-style-type: none">• 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.
10 Fuel Systems (ATA 28) <ul style="list-style-type: none">• System lay-out;• Fuel tanks;• Supply systems;• Dumping, venting and draining;• Cross-feed and transfer;• Indications and warnings;• Refuelling and defuelling;• Longitudinal balance fuel systems.
11 Hydraulic Power (ATA 29) <ul style="list-style-type: none">• System lay-out;• 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.
12 Ice and Rain Protection (ATA 30) <ul style="list-style-type: none">• Ice formation, classification and detection;• Anti-icing systems: electrical, hot air and chemical;• De-icing systems: electrical, hot air, pneumatic and chemical;• Rain repellent;• Probe and drain heating.• Wiper systems
13 Landing Gear (ATA 32) 2 3 — <ul style="list-style-type: none">• Construction, shock absorbing;• Extension and retraction systems: normal and emergency;• Indications and warning;

<ul style="list-style-type: none">• Wheels, brakes, antiskid and autobraking;• Tyres;• Steering.
14 Lights (ATA 33) <ul style="list-style-type: none">• External: navigation, anti-collision, landing, taxiing, ice;• Internal: cabin, cockpit, cargo;• Emergency.
15 Oxygen (ATA 35) <ul style="list-style-type: none">• System lay-out: cockpit, cabin;• Sources, storage, charging and distribution;• Supply regulation;• Indications and warnings;
16 Pneumatic/Vacuum (ATA 36) <ul style="list-style-type: none">• System lay-out;• Sources: engine/APU, compressors, reservoirs, ground supply;• Pressure control;• Distribution;• Indications and warnings;• Interfaces with other systems.
17 Water/Waste (ATA 38) <ul style="list-style-type: none">• Water system lay-out, supply, distribution, servicing and draining;• Toilet system lay-out, flushing and servicing;• Corrosion aspects.
18 On Board Maintenance Systems (ATA 45) <ul style="list-style-type: none">• Central maintenance computers;• Data loading system;• Electronic library system;• Printing;• Structure monitoring (damage tolerance monitoring).

Module 10 PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

1 Theory of Flight

1.1 *Aeroplane Aerodynamics and Flight Controls*

- Operation and effect of:
 - roll control: ailerons and spoilers;
 - pitch control: elevators, stabilators, variable incidence
- stabilisers 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 antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels

1.2 *High Speed Flight—N/a*

2 Airframe Structures — General Concepts

(a)

- 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

(b)

- Construction methods of: 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, anodising, painting;
- Surface cleaning;
- Airframe symmetry: methods of alignment and symmetry checks.

3 Airframe Structures — Aeroplanes

<p>3.1 <i>Fuselage</i></p> <ul style="list-style-type: none">• Construction and pressurisation sealing;• Wing, tail-plane pylon and undercarriage attachments;• Seat installation;• Doors and emergency exits: construction and operation;• Window and windscreen attachment.
<p>3.2 <i>Wings</i></p> <ul style="list-style-type: none">• Construction;• Fuel storage;• Landing gear, pylon, control surface and high lift/drag attachments.
<p>3.3 <i>Stabilisers</i></p> <ul style="list-style-type: none">• Construction;• Control surface attachment.
<p>3.4 <i>Flight Control Surfaces</i></p> <ul style="list-style-type: none">• Construction and attachment;• Balancing — mass and aerodynamic.
<p>3.5 <i>Nacelles/Pylons (ATA 54)</i></p> <p>(a)</p> <ul style="list-style-type: none">• Nacelles/Pylons:• Construction;• Firewalls;• Engine mounts.
<p>4 <i>Air Conditioning and Cabin Pressurisation</i></p> <ul style="list-style-type: none">• Pressurisation and air conditioning systems;• Cabin pressure controllers, protection and warning devices.
<p>5 <i>Instruments/Avionic Systems</i></p> <p>5.1 <i>Instrument Systems</i></p> <ul style="list-style-type: none">• Pitot static: altimeter, air speed indicator, vertical speed indicator;• Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading;• Angle of attack indication, stall warning systems.• Other aircraft system indication.
<p>5.2 <i>Avionic Systems</i></p> <ul style="list-style-type: none">• Fundamentals of system lay-outs and operation of:<ul style="list-style-type: none">— Auto Flight (ATA 22);— Communications (ATA 23);

— Navigation Systems (ATA 34).
<p>6 Electrical Power (ATA 24)</p> <ul style="list-style-type: none">• Batteries Installation and Operation;• DC power generation;• Voltage regulation;• Power distribution;• Circuit protection;• Inverters, transformers.
<p>7 Equipment and Furnishings (ATA 25)</p> <p>(a)</p> <ul style="list-style-type: none">• Emergency equipment requirements;• Seats, harnesses and belts. <p>(b)</p> <ul style="list-style-type: none">• Cabin lay-out;• Equipment lay-out;• Cabin Furnishing Installation (level 2);• Cabin entertainment equipment;• Galley installation;• Cargo handling and retention equipment; Airstairs.
<p>8 Fire Protection (ATA 26)</p> <p>(a)</p> <ul style="list-style-type: none">• Fire extinguishing systems;• Fire and smoke detection and warning systems;• System tests. <p>(b)</p> <ul style="list-style-type: none">• Portable fire extinguisher
<p>9 Flight Controls (ATA 27)</p> <ul style="list-style-type: none">• Primary controls: aileron, elevator, rudder;• Trim tabs;• High lift devices;• System operation: manual;• Gust locks;• Balancing and rigging;• Stall warning system.
<p>10 Fuel Systems (ATA 28)</p> <ul style="list-style-type: none">• System lay-out;• Fuel tanks;• Supply systems;• Cross-feed and transfer;

<ul style="list-style-type: none">• Indications and warnings;• Refuelling and defuelling.
11 Hydraulic Power (ATA 29) <ul style="list-style-type: none">• System lay-out;• Hydraulic fluids;• Hydraulic reservoirs and accumulators;• Pressure generation: electric, mechanical;• Pressure Control;• Power distribution;• Indication and warning systems.
12 Ice and Rain Protection (ATA 30) <ul style="list-style-type: none">• Ice formation, classification and detection;• De-icing systems: electrical, hot air, pneumatic and chemical;• Probe and drain heating;• Wiper systems.
13 Landing Gear (ATA 32) <ul style="list-style-type: none">• Construction, shock absorbing;• Extension and retraction systems: normal and emergency;• Indications and warning;• Wheels, brakes, antiskid and autobraking;• Tyres;• Steering.
14 Lights (ATA 33) <ul style="list-style-type: none">• External: navigation, anti collision, landing, taxiing, ice;• Internal: cabin, cockpit, cargo;• Emergency.
15 Oxygen (ATA 35) <ul style="list-style-type: none">• System lay-out: cockpit, cabin;• Sources, storage, charging and distribution;• Supply regulation;• Indications and warnings
16 Pneumatic/Vacuum (ATA 36) <ul style="list-style-type: none">• System lay-out;• Sources: engine/APU, compressors, reservoirs, ground supply;• Pressure control;• Distribution;• Indications and warnings;• Interfaces with other systems.

17 Water/Waste (ATA 38)

- Water system lay-out, supply, distribution, servicing and draining;
- Toilet system lay-out, flushing and servicing;
- Corrosion aspects.

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Module 11 GAS TURBINE ENGINE
1 Fundamentals <ul style="list-style-type: none">• 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, turboshaft, turboprop.
2 Engine Performance <ul style="list-style-type: none">• Gross thrust, net thrust, choked nozzle thrust, 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.
3 Inlet <ul style="list-style-type: none">• Compressor inlet ducts• Effects of various inlet configurations;• Ice protection.
4 Compressors <ul style="list-style-type: none">• 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.
5 Combustion Section <p>Constructional features and principles of operation.</p>
6 Turbine Section <ul style="list-style-type: none">• Operation and characteristics of different turbine blade types;• Blade to disk attachment;• Nozzle guide vanes;• Causes and effects of turbine blade stress and creep.
7 Exhaust <ul style="list-style-type: none">• Constructional features and principles of operation;

<ul style="list-style-type: none">• Convergent, divergent and variable area nozzles;• Engine noise reduction;• Thrust reversers.
8 Bearings and Seals <ul style="list-style-type: none">• Constructional features and principles of operation.
9 Lubricants and Fuels <ul style="list-style-type: none">• Properties and specifications;• Fuel additives;• Safety precautions.
10 Lubrication Systems <ul style="list-style-type: none">• System operation/lay-out and components.
11 Fuel Systems <ul style="list-style-type: none">• Operation of engine control and fuel metering systems including electronic engine control (FADEC);• Systems lay-out and components.
12 Air Systems <ul style="list-style-type: none">• Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.
13 Starting and Ignition Systems <ul style="list-style-type: none">• Operation of engine start systems and components;• Ignition systems and components;• Maintenance safety requirements.
14 Engine Indication Systems <ul style="list-style-type: none">• Exhaust Gas Temperature/Interstage 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.
15 Power Augmentation Systems <ul style="list-style-type: none">• Operation and applications;• Water injection, water methanol;• Afterburner systems.
16 Turbo-prop Engines <ul style="list-style-type: none">• Gas coupled/free turbine and gear coupled turbines;• Reduction gears;

<ul style="list-style-type: none">• Integrated engine and propeller controls;• Overspeed safety devices.
17 Turbo-shaft engines <ul style="list-style-type: none">• Arrangements, drive systems, reduction gearing, couplings, control systems.
18 Auxiliary Power Units (APUs) <ul style="list-style-type: none">• Purpose, operation, protective systems
19 Powerplant Installation <ul style="list-style-type: none">• 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.
20 Fire Protection Systems <ul style="list-style-type: none">• Operation of detection and extinguishing systems.
21 Engine Monitoring and Ground Operation <ul style="list-style-type: none">• Procedures for starting and ground run-up;• Interpretation of engine power output and parameters;• Trend monitoring (including oil analysis, vibration and boroscope)• Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer;• Compressor washing/cleaning;• Foreign Object Damage.
22 Engine Storage and Preservation — 2 — <ul style="list-style-type: none">• Preservation and depreservation for the engine and accessories/systems.

Module 12 . HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS

1 Theory of Flight — Rotary Wing Aerodynamics

- Terminology;
- Effects of gyroscopic precession;
- Torque reaction and directional control;
- Dissymmetry of lift, Blade tip stall;
- Translating tendency and its correction;
- Coriolis effect and compensation;
- Vortex ring state, power settling, overpitching;
- Auto-rotation;
- Ground effect.

2 Flight Control Systems

- Cyclic control;
- Collective control;
- Swashplate;
- Yaw control: Anti-Torque Control, Tail rotor, bleed air;
- Main Rotor Head: Design and Operation features;
- Blade Dampers: Function and construction;
- Rotor Blades: Main and tail rotor blade construction and attachment;

- Trim control, fixed and adjustable stabilisers;
- System operation: manual, hydraulic, electrical and fly-bywire; Artificial feel;

- Balancing and Rigging.

3 Blade Tracking and Vibration Analysis

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

4 Transmissions

- Gear boxes, main and tail rotors;
- Clutches, free wheel units and rotor brake.

5 Airframe Structures

(a)

- 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.

(b)

- Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning and anti-corrosive protection.
- Pylon, stabiliser and undercarriage attachments;
- Seat installation;
- Doors: construction, mechanisms, operation and safety devices;
- Windows and windscreen construction;
- Fuel storage;
- Firewalls;
- Engine mounts;
- Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting;
- Surface cleaning.
- Airframe symmetry: methods of alignment and symmetry checks.

.6 Air Conditioning

6.1 Air supply

- Sources of air supply including engine bleed and ground cart

6.2 Air Conditioning

- Air conditioning systems;
- Distribution systems;
- Flow and temperature control systems;
- Protection and warning devices.

7 Instruments/Avionic Systems

7.1 Instrument Systems (ATA 31)

- Pitot static: altimeter, air speed indicator, vertical speed indicator;
- Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator;
- Compasses: direct reading, remote reading;
- Vibration indicating systems — HUMS;
- Other aircraft system indication.

7.2 Avionic Systems

- Fundamentals of system layouts and operation of:
- Auto Flight (ATA 22);
- Communications (ATA 23);
- Navigation Systems (ATA 34).

8 Electrical Power (ATA 24) 1 3 —

- Batteries Installation and Operation;
- DC power generation, AC power generation;
- Emergency power generation;
- Voltage regulation, Circuit protection.
- Power distribution;
- Inverters, transformers, rectifiers;
- External/Ground power.

9 Equipment and Furnishings (ATA 25)

- Emergency equipment requirements;
- Seats, harnesses and belts;
- Lifting systems.
- Emergency flotation systems;
- Cabin lay-out, cargo retention;
- Equipment lay-out;
- Cabin Furnishing Installation.

10 Fire Protection (ATA 26) 1 3 —

- Fire and smoke detection and warning systems;
- Fire extinguishing systems;
- System tests.

11 Fuel Systems (ATA 28) 1 3 —

- System lay-out;
- Fuel tanks;
- Supply systems;
- Dumping, venting and draining;
- Cross-feed and transfer;
- Indications and warnings;
- Refuelling and defuelling.

12 Hydraulic Power (ATA 29)

- System lay-out;
- 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.

13 Ice and Rain Protection (ATA 30)

- Ice formation, classification and detection;
- Anti-icing and de-icing systems: electrical, hot air and chemical;
- Rain repellent and removal;
- Probe and drain heating.

14 Landing Gear (ATA 32)

- Construction, shock absorbing;
- Extension and retraction systems: normal and emergency;
- Indications and warning;
- Wheels, tyres, brakes;
- Steering;
- Skids, floats.

15 Lights (ATA 33)

- External: navigation, landing, taxiing, ice;
- Internal: cabin, cockpit, cargo;
- Emergency.

16 Pneumatic/Vacuum (ATA 36)

- System lay-out;
- Sources: engine, compressors, reservoirs, ground supply.;
- Pressure control;
- Distribution;
- Indications and warnings;

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Module 13 PISTON ENGINE

1 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.

2 Engine Performance

- Power calculation and measurement;
- Factors affecting engine power;
- Mixtures/leaning, pre-ignition.

3 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.

4 Engine Fuel Systems

4.1 Carburettors

Types, construction and principles of operation; Icing and heating.

4.2 Fuel injection systems

Types, construction and principles of operation.

4.3 Electronic engine control

Operation of engine control and fuel metering systems including electronic engine control (FADEC);

Systems lay-out and components.

4.5 Starting and Ignition Systems

Starting systems, pre-heat systems; Magneto types, construction and principles of operation;

Ignition harnesses, spark plugs;

Low and high tension systems.

4.6 Induction, Exhaust and Cooling Systems

Construction and operation of: induction systems

including alternate air systems;

Exhaust systems, engine cooling systems — air and liquid.

4.7 Supercharging/Turbocharging

Principles and purpose of supercharging and its effects on engine parameters;

Construction and operation of supercharging/turbocharging systems;

System terminology;

Control systems;

System protection.

4.8 Lubricants and Fuels

Properties and specifications;

Fuel additives;

Safety precautions.

4.9 Lubrication Systems

System operation/lay-out and components.

4.10 Engine Indication Systems

- Engine speed;
- Cylinder head temperature;
- Coolant temperature;
- Oil pressure and temperature;
- Exhaust Gas Temperature;
- Fuel pressure and flow;
- Manifold pressure.

4.11 Powerplant Installation

- 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.

4.12 Engine Monitoring and Ground Operation

- Procedures for starting and ground run-up;
- Interpretation of engine power output and parameters;
- Inspection of engine and components: criteria, tolerances,
- and data specified by engine manufacturer.

4.13 Engine Storage and Preservation <ul style="list-style-type: none">• Preservation and depreservation for the engine and accessories/ systems.
5. PROPELLER
1 Fundamentals <ul style="list-style-type: none">• Blade element theory;• High/low blade angle, reverse angle, angle of attack, rotational speed;• Propeller slip;• Aerodynamic, centrifugal, and thrust forces;• Torque;• Relative airflow on blade angle of attack;• Vibration and resonance.
2 Propeller Construction 1 2 — <ul style="list-style-type: none">• 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.
3 Propeller Pitch Control <ul style="list-style-type: none">• Speed control and pitch change methods, mechanical and electrical/electronic;• Feathering and reverse pitch;• Overspeed protection.
4 Propeller Synchronizing <ul style="list-style-type: none">• Synchronizing and synchrophasing equipment.
5 Propeller Ice Protection <ul style="list-style-type: none">• Fluid and electrical de-icing equipment.
6 Propeller Maintenance <ul style="list-style-type: none">• Static and dynamic balancing;• Blade tracking;• Assessment of blade damage, erosion, corrosion, impact damage, delamination;• Propeller treatment/repair schemes;• Propeller engine running.
7 Propeller Storage and Preservation <p>Propeller preservation and depreservation</p>

Module 14 PROPELLER

1 Fundamentals

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

2 Propeller Construction 1 2 —

- 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.

3 Propeller Pitch Control

- Speed control and pitch change methods, mechanical and electrical/electronic;
- Feathering and reverse pitch;
- Overspeed protection.

4 Propeller Synchronising

- Synchronising and synchrophasing equipment.

5 Propeller Ice Protection

- Fluid and electrical de-icing equipment.

6 Propeller Maintenance

- Static and dynamic balancing;
- Blade tracking;
- Assessment of blade damage, erosion, corrosion, impact damage, delamination;
- Propeller treatment/repair schemes;
- Propeller engine running.

7 Propeller Storage and Preservation

Propeller preservation and depreservation

Module 15 AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS

1 Theory of Flight

(a) *Aeroplane Aerodynamics and Flight Controls*

- Operation and effect of:
 - roll control: ailerons and spoilers;
 - pitch control: elevators, stabilators, variable incidence stabilisers and canards;
 - yaw control, rudder limiters;
- Control using elevons, ruddervators;
- High lift devices: slots, slats, flaps;
- Drag inducing devices: spoilers, lift dumpers, speed brakes;
- Operation and effect of trim tabs, servo tabs, control surface bias.

(b) *Aeroplane Aerodynamics and Flight Controls*

- Operation and effect of:
 - roll control: ailerons and spoilers;
 - pitch control: elevators, stabilators, variable incidence stabilisers and canards;
 - yaw control, rudder limiters;
- Control using elevons, ruddervators;
- High lift devices: slots, slats, flaps;
- Drag inducing devices: spoilers, lift dumpers, speed brakes;
- Operation and effect of trim tabs, servo tabs, control surface bias.

(c) High Speed Flight

- Speed of sound, subsonic flight, transonic flight, supersonic flight,
- Mach number, critical Mach number.

(d) Rotary Wing Aerodynamics

- Terminology;
- Operation and effect of cyclic, collective and anti-torque controls.

2 Structures — General Concepts

(a)

- Fundamentals of structural systems.

(b)

- Zonal and station identification systems;
- Electrical bonding;
- Lightning strike protection provision.

3 Autoflight (ATA 22)

- Fundamentals of automatic flight control including working principles and current terminology;
- Command signal processing;
- Modes of operation: roll, pitch and yaw channels;
- Yaw dampers;
- Stability Augmentation System in helicopters;
- Automatic trim control;
- Autopilot navigation aids interface;
- Autothrottle systems.
- Automatic Landing Systems: principles and categories, modes of operation, approach, glideslope, land, go-around,
- system monitors and failure conditions.

4 Communication/Navigation (ATA 23/34)

- Fundamentals of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter;
- Working principles of following systems:
 - Very High Frequency (VHF) communication;
 - High Frequency (HF) communication;
 - Audio;
 - Emergency Locator Transmitters;
 - Cockpit Voice Recorder;
 - Very High Frequency omnidirectional range (VOR);
 - Automatic Direction Finding (ADF);
 - Instrument Landing System (ILS);
 - Microwave Landing System (MLS);
 - Flight Director systems;
 - Distance Measuring Equipment (DME);
 - Doppler navigation;
 - Area navigation, RNAV systems;
 - Flight Management Systems;
 - Global Positioning System (GPS),
 - Global Navigation
- Satellite Systems (GNSS);
 - Inertial Navigation System;
 - Air Traffic Control transponder, secondary surveillance radar;
 - Traffic Alert and Collision Avoidance System (TCAS);
 - Weather avoidance radar;
 - Radio altimeter;
 - ARINC communication and reporting;

5 Electrical Power (ATA 24)

- Batteries Installation and Operation;
- DC power generation;
- AC power generation;
- Emergency power generation;
- Voltage regulation;
- Power distribution;
- Inverters, transformers, rectifiers;
- Circuit protection;
- External/Ground power.

6 Equipment and Furnishings (ATA 25)

- Electronic emergency equipment requirements;
- Cabin entertainment equipment.

7 Flight Controls (ATA 27)

(a)

- Primary controls: aileron, elevator, rudder, spoiler;
- Trim control;
- Active load control;
- High lift devices;
- Lift dump, speed brakes;
- System operation: manual, hydraulic, pneumatic;
- Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks.
- Stall protection systems.

(b)

System operation; electrical fly by wire 8 instrument system (ATA 31)

- Classification;
- Atmosphere;
- Terminology;
- Pressure measuring devices and systems;
- Pitot static systems;
- Altimeters;
- Vertical speed indicators;
- Airspeed indicators;
- Machmeters;
- Altitude reporting/alerting systems;
- Stall warning systems and angle of attack indicating systems;
- Vibration measurement and indication.
- Air data computers;
- Instrument pneumatic systems;
- Direct reading pressure and temperature gauges;
- Temperature indicating systems;
- Fuel quantity indicating systems;
- Gyroscopic principles;
- Artificial horizons;
- Slip indicators;
- Directional gyros;
- Ground Proximity Warning Systems;
- Compass systems;
- Flight Data Recording systems;
- Electronic Flight Instrument Systems;
- Instrument warning systems including master warning systems and centralised warning panels;

9 Lights (ATA 33)

- External: navigation, landing, taxiing, ice;
- Internal: cabin, cockpit, cargo;
- Emergency.

10 On board Maintenance Systems (ATA 45)

- Central maintenance computers;
- Data loading system;
- Electronic library system;
- Printing;
- Structure monitoring (damage tolerance monitoring).

Module 16 **PROPULSION**

1 Turbine Engines

(a)

- Constructional arrangement and operation of turbojet, turbofan, turboshaft and turbopropeller engines;

(b)

- Electronic Engine control and fuel metering systems (FADEC).

2 Engine Indicating Systems

- Exhaust gas temperature/Interstage turbine temperature systems;
- Engine speed;
- Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems;
- Oil pressure and temperature;
- Fuel pressure, temperature and flow;
- Manifold pressure;
- Engine torque;
- Propeller speed.

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Annexure 3



DIRECTORATE GENERAL OF CIVIL AVIATION

CENTRAL EXAMINATION ORGANIZATION

East Block III, RK Puram, New Delhi 110066

CERTIFICATE

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This is to certify that

Mr./Ms

Computer

No.

Has passed the following subjects/module papers examinations conducted by this office in partial fulfillment of requirements for grant of aircraft maintenance engineer's license.

.....

.....

Subject/ Module names

Session in which passed

End.

Sd/-

**CIVIL AVIATION REQUIREMENTS
SERIES 'L' PART II**

**SECTION 2-AIRWORTHINESS
01 SEPTEMBER 2009**

Director of Airworthiness
Head, Central Examination Organization
For the Director General of Civil Aviation

Seal

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