



**CAA TECHNICAL EXAMINATIONS
(PERSONNEL LICENCES, RATINGS & CERTIFICATES)**

AIR NAVIGATION ORDER

VERSION : 2.0
DATE OF IMPLEMENTATION : 16-05-2011
OFFICE OF PRIME INTEREST : Personnel Licensing Office

	NAME	DESIGNATION	SIGNATURE
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REVIEWED BY	Captain SYED AFTAB HUSAIN	General Manager Licensing	
APPROVED BY	Air Marshal (Retd.) KHALID CHOUDHRY	Director General Civil Aviation Authority	
TYPE OF DOCUMENT	AIR NAVIGATION ORDER (ANO).		
STATUS OF DOCUMENT	CONTROLLED		

A. AUTHORITY:

A1. This Air Navigation Order (ANO) is issued by the Director General Civil Aviation Authority in pursuance of powers vested in him under Rule 4(3), 36, 45, 46, 47, 354, 357, 360 and all other enabling provisions of Civil Aviation Rules, 1994 (CARs, 94).

B. PURPOSE:

B1. Annex 1 – Personnel Licensing establishes Standards and Recommended Practices of knowledge for various Licenses and ratings. In order to ascertain whether a Licence applicant has the required knowledge, the Authority conducts a number of examinations. The purpose of this ANO is to provide regulatory framework for the conduct of CAA Technical Examinations for the issuance of personnel Licenses.

C. SCOPE:

C1. This ANO covers the rules governing the CAA Technical Examinations of Aircraft Pilots, Flight Engineers, Aircraft Maintenance Engineers, Air Traffic Controllers, Glider Pilots, Balloon pilots, Pilots of Uncertified Flying Machines, Cabin Attendants, Flight Radio Telephony Operator Licence, Flight Operations Officers Licence, Ratings, Type Endorsements, Validation Certificates, conduct of Examinations etc.

C2. Unless contrary intentions appears, this ANO shall also be read in conjunction with the other Personnel Licensing ANOs and other instructions issued by the CAA from time to time.

D. DESCRIPTION:

D1. INTRODUCTION:

D1.1 An applicant for the grant of a Licence, Certificate or a rating shall pass theory Examinations in accordance with the syllabus and procedures provided for, in this ANO.

D1.2 The general policy in relation to theory examinations is outlined in this ANO; and related information in the context of Licenses, Certificates, Ratings etc., is specified in the relevant ANOs of Licenses, Certificates and Ratings.

D1.3 All applications concerning CAA Technical Examinations for Licenses, Certificates and Ratings shall be addressed to the Personnel Licensing Office (PLO).

D1.4 This ANO covers the under mentioned examinations:

D1.4.1 Private Pilot Licence : Aeroplane & Helicopter

D1.4.2 Commercial Pilot Licence : Aeroplane & Helicopter

D1.4.3 Airline Transport Pilot Licence : Aeroplane & Helicopter

D1.4.4 Instrument Rating : Aeroplane & Helicopter

D1.4.5 Flight Instructors Rating

D1.4.6 Flight Engineer Licence

D1.4.7 Flight Operations Officers Licence

D1.4.8 Aircraft Maintenance Engineer Licence

- D1.4.9 Air Traffic Controller Licence / Ratings
- D1.4.10 Approved Person Examination
- D1.4.11 Glider Pilot Licence
- D1.4.12 Balloon Pilot Licence
- D1.4.13 Agriculture Rating
- D1.4.14 Flight Radio Telephony Operator Licence
- D1.4.15 Cabin Attendant Competency Certificate
- D1.4.16 Microlight Competency Certificate
- D1.4.17 Validation Certificate

D2. **DETAILS OF TECHNICAL EXAMINATION:**

- D2.1 The Appendices to this ANO contain the under mentioned details:
 - D2.1.1 Syllabus of Examinations
 - D2.1.2 Break down of the papers
 - D2.1.3 Approximate questions likely to be set from each module of the syllabus.
 - D2.1.4 Recommended study material / Books.
 - D2.1.5 The details of Technical Examinations are attached at the appendices as under:
 - D2.1.5.1 Appendix A - Private Pilot Licence (A & H)
 - D2.1.5.2 Appendix B - Commercial Pilot Licence (A & H)
 - D2.1.5.3 Appendix C - Airline Transport Pilot Licence (A & H) Instrument Rating
 - D2.1.5.4 Appendix D - Instrument Rating
 - D2.1.5.5 Appendix E - Instructor Rating
 - D2.1.5.6 Appendix F - Balloon Pilot Licence
 - D2.1.5.7 Appendix G - Microlight Competency Certificate
 - D2.1.5.8 Appendix H - Glider Pilot Licence Flight Engineer Licence
 - D2.1.5.9 Appendix J - Flight Engineer Licence
 - D2.1.5.10 Appendix K - Flight Operations Officer Licence
 - D2.1.5.11 Appendix L - Air Traffic Controller Licence
 - D2.1.5.12 Appendix M - Flight Radio Telephony Operator Licence
 - D2.1.5.13 Appendix N - Aircraft Maintenance Engineer Licence
 - D2.1.5.14 Appendix P - Cabin Attendant – Competency Certificates
 - D2.1.5.15 Appendix R - Validation Certificate
 - D2.1.5.16 Appendix S - Type Rating
 - D2.1.5.17 Appendix T - Approved Person Examination
 - D2.1.5.18 Appendix U - Agriculture Rating

D3. **GENERAL CONSIDERATIONS – PAPER SETTING:**

D3.1 All question papers shall be confined to the syllabus recommended by ICAO Annex 1; and related documents as provided for in this Air Navigation Order.

D3.2 Unless otherwise specified, all question papers for initial issue of Licence shall carry maximum of 100 questions. The question papers for revalidation / renewals shall have maximum of 50 questions.

D3.3 Each candidate sitting in the examination shall be given a different question paper.

D3.4 Unless otherwise specified, time for each paper shall be 3 Hours.

D3.5 Passing marks of all examinations for the issuance, renewal, validation and approvals of Licenses, Certificates and Ratings shall be 70%.

D3.6 The rough work done during the examination shall be a part of the answer sheet and shall be submitted along with the answer sheet.

D3.7 **DETAILS OF PAPERS:**

Private Pilot Licence	<ol style="list-style-type: none"> 1. Aircraft General Knowledge & Principles of Flight 2. Air Law, ATC Procedures & Operational Procedures 3. Meteorology And Flight Planning 4. Performance, Human Performance & Behavior 5. Mass & Balance And General Navigation 6. VFR Communication And Instrumentation 7. FRTOL (Oral Exam)
PPL Re-validation	PPL-R
Commercial Pilot Licence	<ol style="list-style-type: none"> 1. Aircraft General Knowledge & Principles of Flight 2. Air Law, ATC Procedures And Operational Procedures 3. Meteorology And Flight Planning 4. Performance, Human Performance & Behavior 5. Mass And Balance And General Navigation 6. Radio navigation and Instrumentation 7. Instrument Procedures 8. VFR and IFR Communication
CPL Re-validation	CPL-R
Instrument Rating	IR
IR Re-validation	IR-R
Airline Transport Pilot Licence	<ol style="list-style-type: none"> 1. Aircraft General Knowledge & Principles of Flight

	2. Air Law, ATC Procedures And Operational Procedures
	3. Meteorology And Flight Planning
	4. Performance, Human Performance & Behavior
	5. Mass And Balance And General Navigation
	6. Radio navigation and Instrumentation
	7. Instrument Procedures
	8. VFR and IFR Communication
ATPL Re-validation	ATPL-R
Flight Instructor Rating	FI
Balloon Pilot Licence	BPL
BPL Re-validation	BPL-R
Flight Engineer Licence	FE
FEL Revalidation	FE-R
Flight Operations Officer Licence	1. Aircraft General Knowledge & Principles of Flight 2. Air Law, ATC Procedures And Operational Procedures 3. Meteorology And Flight Planning 4. Performance, Human Performance & Behavior 5. Mass And Balance And General Navigation 6. Radio navigation and Instrumentation 7. Instrument Procedures 8. VFR and IFR Communication
FOO Revalidation	FOO-R
Aircraft Maintenance Engineer Licence (Basic)	1. Airframe (above 5700kgs/ below 5700kgs/ high speed) 2. Gas Turbine / Piston Engine 3. Electrical 4. Instrument 5. Communication/Navigation 6. Radar
AME (Aircraft Ratings)	Conducted by Airworthiness Directorate
Air Traffic Controller Licence	ATC-1, ATC-2
ATC Ratings	Conducted by CATI / Operations Directorate

ATC Re-validation	ATC-R
Glider Pilot Licence	GPL-1,GPL-2
GPL Revalidation	GPL-R
Cabin Competency Certificate	Cabin-1, Cabin-2
Cabin Competency Revalidation	Cabin- R
Validation Certificate	VAL-1
Microlight Competency Certificate	MCC-1
MCC Revalidation	MCC-R
Agriculture Rating	AG-1
Flight Radio Telephony Operator Licence	FRTO-1
Type Technical	TT-1
Approved Person	AP-1

D3.8 A candidate for PPL-H shall pass papers of PPL and PPL-H both.

D3.9 A candidate for CPL-H shall pass papers of CPL and CPL-H.

D3.10 A candidate for ATPL-H shall pass papers of ATPL and ATPL-H.

D4. **EXAMINATION VALIDITY CREDIT:**

D4.1 All pass credit of examination paper shall be in accordance with the period as specified in this ANO.

D5. **EXAMINATION CENTRES:**

D5.1 The examinations shall be conducted at Karachi, Lahore, and Islamabad according to the published schedule. Examinations at any other center shall only be conducted if reasonable numbers of candidates are available. At Karachi, the examinations shall be held at the Licensing Office; and at other centers, at the Airport Terminals, under the administrative arrangements of Airport Managers.

D6. **APPLICATION PROCEDURE:**

D6.1 A candidate shall submit the application form, CAAF-608-XXLC-2.0, for the required theory examination, he shall:

D6.1.1. Ensure that he meets the eligibility requirements for the required Licence, Certificate and Rating as given in the relevant ANOs.

D6.2 The authorized person of the aviation training organization shall recommend the application for each attempt. Qualified personnel of the Armed forces, foreign equivalent Licence / Certificate holders and candidates for renewal, revalidation, type endorsements are exempted from this requirement

D6.3 The application shall be submitted to reach the Licensing office not later than 07 days before the scheduled date. A late fee shall be charged, if application is submitted late. Authority is not responsible for postal delays.

D7. **EXAMINATION SCHEDULE:**

D7.1 The Personnel Licensing office shall issue a six monthly examination schedule. In case of a gazetted holiday, the scheduled papers shall be held on the next working day.

D8. **CHANGE OF CENTRE/DATE:**

D8.1 A candidate in writing may apply for the change of a center or date of examination. Such a request is to reach at least 02 days before the commencement of the examination. In such cases, fee deposited earlier will be adjusted towards next examination, provided it is taken within next 12 weeks.

D9. **AIRCRAFT TYPE TECHNICAL EXAMINATION:**

D9.1 The Aircraft Type Technical Examination (TT-1) for aircraft below AUW 5700 KGS., Shall be conducted by the Licensing Office or delegated to the Authorized Person / Aviation Training Organization. The details of the examination are given in Appendix 'S' of this ANO.

D9.2 Results and answer sheets properly marked and signed are to be forwarded to Licensing Office, for the licensing action, along with other required documents.

D9.3 Where an applicant has completed an approved course with an approved aviation training organization for aircraft AUW 5700 KGS and above, such course shall be accepted in lieu of Technical Examination (TT-2). The aviation training organization shall provide the schedule for the conduct of such examination to the Licensing Office, which shall monitor the conduct of such examinations, without any prior notice and scrutinize if required some sample answer sheets.

D9.4 The validity of the aircraft type technical examination shall be 06 months.

D10. **ORAL EVALUATION BY AUTHORIZED PERSON:**

D10.1 An authorized person shall conduct oral assessment / examinations for issue or revalidation of lapsed licenses and ratings with a valid authorization issued by the Licensing Office. The examiner conducting the oral assessment shall complete the prescribed form and submit it to the Licensing Office.

D11. **CONDUCT OF SPECIAL EXAMINATION:**

D11.1 Special Examination for issue / revalidation may be permitted, out of the published schedule, for applicants from abroad.

D12. **EXAMINATION FEE SHEDULE:**

D12.1 The details of examination fee shall be as given in ANO-021-XXLC-2.0.

D12.2 **LATE FEE:**

D12.2.1 Late fee shall be charged on applications received within last 07 days of examination.

D13. **EXEMPTIONS:**

D13.1 Exemptions from theory examinations may be granted to qualified and experienced personnel from the Pakistan Armed Forces, in general aviation subjects only, with acceptable documentary evidence of having met the requirements. The Licensing Office may verify, if required, from the concerned service / department. The exemption may be given in following papers for the issuance of CPL i.e., Navigation, Theory of Flight and Aircraft General Knowledge.

D14. **EXAMINATION RESULTS:**

D14.1 All candidates shall be informed of the result and the marks obtained in the examination.

D14.2 Except for the approved person of an aviation training organization, the result shall be disclosed to another person subject to a written authorization from the individual whose result is being disclosed.

D14.3 The result will be dispatched to the candidate through the school recommending his application; or directly, where there was no school involved, within 04 weeks of the examination.

D15. **CANDIDATES REQUEST FOR RE-CHECKING:**

D15.1 A candidate may request for re-checking of answer sheets. An examiner shall review the paper to determine if there was an error. The burden of proof, to prove that answer was correct, lies with the candidate. In case of a doubt, the case may be referred to the General Manager Licensing for necessary decision.

D15.2 If a question is found inappropriate for the paper under re-check, the question shall be removed; and the score shall be given out of the remaining questions.

D15.3 A candidate may apply for re-checking of his papers within two months of the dispatch of results, on payment of the prescribed fee.

D16. **DISPOSITION OF ANSWER SHEETS OF EXAMINATIONS:**

D16.1 The answer sheets shall be retained by the Licensing office for a period of 03 months.

A1.1 The answer sheets shall be incinerated after 03 months in the presence of cm examination.

A2. **CONDUCT OF CAA TECHNICAL EXAMINATION:**

A2.1 Except as authorized by an invigilator, a candidate appearing in the examinations shall follow the under mentioned instructions:

A2.1.1 All candidates to be seated 10 minutes prior to the scheduled time for the commencement of paper. In case of late arrival, a candidate may be allowed to sit in the examination but no extra time will be given.

A2.1.2 Copying or removing from any portion of the text of the paper is not permitted.

A2.1.3 Handing over or accepting from any person, a copy of the text of the paper is not permitted.

A2.1.4 Giving help to or accepting help from any person during the examination is not permitted.

A2.1.5 Completing all or any portion of the examination on behalf of any other person is not permitted.

A2.1.6 Using any outside aid or written material during the examination is not permitted.

A2.1.7 Mobile phone are prohibited in the examination centre

A2.2 Prior to the commencement of the examination, the examiner shall loudly read out the under mentioned instructions to all the candidates:

A2.2.1 All candidates are required to be in possession of identification acceptable to the examiner. The identification can be either of the following, original national Identity Card (CNIC), Licence, Passport, or any other document identifying him to the satisfaction of the examiner.

A2.2.2 Candidates are to write the TEST NUMBER and REFERENCE NUMBER clearly on the answer sheet.

A2.2.3 Candidates, who do not have their applications recommended by the Authorized person, if applicable, are not allowed to sit in the examination.

A2.2.4 Any candidate, who does not meet the eligibility criteria for the examination and sits in examination, shall lose the chance; and his result will not be declared.

A2.2.5 All answers are to be written on the answer sheet provided for. Nothing is to be written or marked on the question paper. A separate blank sheet is provided for working / rough work, which **is part of the answer sheet** and is to be attached along with the answer sheet.

A2.2.6 Exchange of computers, calculators and stationary is not to be permitted during examination.

A2.2.7 A candidate who uses a hand-held calculator during an examination shall use a hand-held calculator, which has the memory-clear feature; and the clear memory shall be demonstrated to the invigilator.

A2.2.8 A candidate who uses a hand-held electronic computer during an examination shall use a hand-held electronic computer provided it has been specifically designed for flight operations its memory can be cleared before and after the examination in the presence of the invigilator; and its memory bank instructions and the process is simple enough to be completed with minimum distraction.

A2.2.9 Candidates are not permitted to consult the computer user manuals or instructions during examination.

A2.2.10 If a candidate is found talking, using unfair means, causing disturbance or not abiding by any of these instructions, the candidate shall be disqualified from the paper apart from other disciplinary action.

A2.2.11 A candidate is not permitted to bring any reference book or any written text into the examination center. Mobile Phones are prohibited in the examination centre.

A2.2.12 All candidates to have their own necessary drawing and calculating equipment, e.g., dividers, compasses protectors and navigational computer etc.

A2.2.13 A PPL candidate is allowed to use only manual navigational computer and non-programmable calculators.

A2.2.14 Undesirables conduct during the examination shall culminate in appropriate disciplinary action as deemed fit by the Licensing Authority.

A2.2.15 Smoking and visiting toilets during the paper is not permitted.

A3. **USE OF ELECTRONIC DEVICES:**

A3.1 List of approved electronic computers is as follows: -

A3.1.1 JEPPESEN/ PROSTAR/ AVSTAR/ TECHSTAR

A3.1.2 ASA CX 1a PATHFINDER

A3.1.3 CESSNA SKY/COMP

A3.1.4 NAV-gem

A3.1.5 SPORTY's E6B

A3.1.6 Any FAA/JAA Approved Computer

A3.1.7

A3.2 DUTIES AND RESPONSIBILITIES OF INVIGILATOR/S

A3.2.1 The duties and responsibilities of the invigilators shall be as under:

A3.2.1.1 He shall compile a list of candidates who have applied to appear in different examination, different examination centers at the scheduled dates.

A3.2.1.2 He shall co-ordinate with the Airport Manager in advance to ensure that the arrangements for the examination to be held are satisfactory.

A3.2.1.3 He shall carry the required number of question papers and other examination material in sufficient quantity and shall keep in his personal custody ensuring its secrecy and security.

A3.2.1.4 He shall arrive at the examination center 30 minutes prior to the schedule time.

A3.2.1.5 He shall satisfy himself with the identity of each candidate through an acceptable identification.

A3.2.1.6 He shall read out the examination instructions loudly 5 minutes before the schedule time of commencement of examination. Then he is to permit the candidates to leave the room, if required, for 5 minutes for drinking water, smoking or visiting toilet.

A3.2.1.7 He shall get the signatures on the nominal roll and attest himself on the answer sheet provided.

A3.2.1.8 He shall announce 'start the paper now' and begin timing. He shall also announce the passage of each hour, last thirty minutes and last five minutes. After the examination time has elapsed, he shall announce 'Stop the paper now' and begin collecting back the question paper, answer sheets and other examination material.

A3.2.1.9 He shall complete the post examination report including any unusual occurrence; and shall get the report counter signed by the Airport Manager.

A4. ORAL EVALUATION FOR KNOWLEDGE ASSESSMENT:

A4.1 The Licensing Authority may direct an applicant for any additional examinations and tests (written or oral), in addition to the examination and tests prescribed in this ANO; if the Authority is not satisfied with the results of an applicant.

A4.2 If a candidate is suspected of using unfair means during an examination, an oral evaluation may be carried out of his knowledge by a team constituted by the GM Licensing. If the oral evaluation report is not satisfactory, the team may recommend to the Licensing Authority to bar the candidate from appearing in the paper for a defined period.

A5. PENALTIES FOR USING UNFAIR MEANS:

A5.1 Penalties resulting from improper conduct/ using unfair means or cheating will be determined by the Licensing office in consultation with Legal branch. Penalties as given in Enforcement manual shall be levied if it is ascertained that the candidate is guilty of using unfair means. Penalties may be time barring, monetary or both. A written report of the incident along with the penalty levied on the candidate will be sent to the Training organisation/ operator who had initially forwarded the candidate's name for examination. The material used in cheating / improper conduct e.g., mobile phones, books, written material or any other electronic gadget will be confiscated and if required will be produced as evidence the time of enquiry.

A6. RESPONSIBILITIES OF THE APM FOR CONDUCT OF EXAMINATION:

A6.1 The Airport Managers shall have the overall responsibility for conducting the Technical Examinations at stations other than HQ CAA. He shall be responsible for providing the following assistance:

A6.1.1 Making a suitable arrangement for the seating of the candidates as per the list issued by the licensing office. The examination place should preferably be an open hall / space, which is free from outside disturbances, is well lit, is airy or air-conditioned.

A6.1.2 Detailing an officer for the assistance of the examiners

A6.1.3 Detailing a helper who will also act as the water bearer

A6.1.4 Providing sufficient stationary for conduct of the examination

A6.1.5 Arranging for a pick up and drop of the examiners detailed.

A7. **ICAO GUIDANCE DOCUMENTS:**

A7.1 ICAO Documents which can provide useful guidance on both Licensing and Examinations are enumerated below:

A7.1.1 Annex 1 Personnel Licensing

A7.1.2 Annex 11 Air Traffic Services

A7.1.3 DOC 4444 Air Traffic Services

A7.1.4 DOC 7192 Training Manual

A7.1.5 Part A-3 Composite Ground subjects

A7.1.6 Part B-1 Instrument Flight Training

A7.1.7 Part B-5 (Vol. 1) Commercial Course details

A7.1.8 Part B-5 (Vol. 11) Instructor briefing sheets

A7.1.9 Part C-3 Training of Flight Engineers

A7.1.10 Part D-3 Training of Flight Operation Officers

A7.1.11 Part D-1 Training of Maintenance Engineers

A7.1.12 Part E-1 Training of Cabin Attendants

A7.1.13 DOC 9401 Manual of Aviation Training Centers

B. EVIDENCES (ACRONYMS / RECORDS / REFERENCES):

B1. **ACRONYMS:**

B1.1	AIP	AERONAUTICAL INFORMATION PUBLICATION
B1.2	ANO	AIR NAVIGATION ORDER
B1.3	APM	AIRPORT MANAGER
B1.4	ATPL-H	ATPL-HELICOPTER
B1.5	DOC	DOCUMENT
B1.6	ICAO	INTERNATIONAL CIVIL AVIATION ORGANIZATION

B2. **RECORDS:**

B2.1	Application form for appearing in the Technical Examination CAAF-006-XXLC-2.0
B2.2	Oral assessment form CAAF-007-XXLC-2.0

- B3. **REFERENCES:**
B3.1 ANO 90.0002 (Issue I)
B3.2 Civil Aviation Rules, 1994
B3.3 ICAO Annex-1

IMPLEMENTATION:

This Air Navigation Order shall be implemented with effect from 16th May, 2011 and supersedes ANO 90.0002 (Issue I).

(KHALID CHOUDHRY)

Air Marshal (Retd.)
Director General,
Pakistan Civil Aviation Authority

Dated: _____

(CAPT. S. AFTAB HUSAIN)

General Manager Licensing

Dated: - _____

File No. HQCAA/1710/03/LIC

APPENDIX "A"

PRIVATE PILOT LICENCE

1. PRIVATE PILOT LICENCE EXAMINATION

1.1. Type of Papers

- 1.1.1. Aircraft General Knowledge & Principles of Flight
- 1.1.2. Air Law, ATC Procedure & Operational Procedure
- 1.1.3. Meteorology and Flight Planning
- 1.1.4. Performance and Human Performance & Behavior
- 1.1.5. Mass & Balance and General Navigation
- 1.1.6. VFR Communication and Instrumentation
- 1.1.7. FRTOL Oral

1.2. Paper PPL

- 1.2.1. Questions : 100
- 1.2.2. Pass percentage : 70%
- 1.2.3. Time allowed : 03:00 hours
- 1.2.4. Validity : 12 months

1.3. PPL-H

- 1.3.1. Questions : 50
- 1.3.2. Pass percentage : 70%
- 1.3.3. Time allowed : 01Hour 30 minutes
- 1.3.4. Validity : 12 months
- 1.3.5. Question Setting : Principles of Flight (Helicopter)

1.4. PPL-R For revalidation of Private Pilot Licence, a candidate shall pass written examination of paper PPL-R.

- 1.4.1. Questions : 50
- 1.4.2. Pass percentage : 70%
- 1.4.3. Time allowed : 01 hour 30 minutes
- 1.4.4. Validity : 12 months
- 1.4.5. Question Setting : Flight Rules and Air law.

1.5. Syllabus: The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a private pilot licence and appropriate to the category of aircraft intended to be included in the licence, in at least the following subjects:

PRIVATE AND COMMERCIAL PILOT LICENCE

TECHNICAL EXAMINATION SYLLABUS

1. Theory Training Syllabus for PPL & CPL.
2. Syllabus for examination for Private Pilot Licence and Commercial Pilot Licence is as follows:
 - 2.1. Aircraft General Knowledge (Including airframe & engines);
 - 2.2. Flight Rules & Air Law;
 - 2.3. Theory of flight;
 - 2.4. Navigation;
 - 2.5. Aircraft operation, performance and planning;
 - 2.6. Meteorology;
 - 2.7. Human performance & limitations, including threat and error management.
3. **AIRCRAFT GENERAL KNOWLEDGE**
 - 3.1. **Engines**
 - 3.1.1 Piston and Gas Turbine Engines
 - 3.1.2 Piston engine
 - 3.1.3 Power: units of power (watt), horsepower (brake horsepower, indicated horsepower, thrust horsepower, shaft horsepower), factors which effect power output, controlling power output rpm/MP.
 - 3.1.4 Piston engine construction and operation: engine nomenclature (major parts and assemblies, cylinder terminology), principle of operation (four stroke cycle, valve timing, ignition timing), schematic construction and functioning.
 - 3.1.5 Engine efficiencies: mechanical, thermal, and volumetric
 - 3.1.6 Carburetor: fuels (types, grades), combustion process (mixture ratios), detonation (contributing factors, effects and indications, stopping and prevention), pre-ignition (contributing factors, effects and indications, stopping and prevention)
 - 3.1.7 Carburetors; basic float carburetor (float chamber, jets, air bleeds, idling system, accelerator pump, economizer system, mixture control system), direct fuel injection (fuel injection pump, fuel/air control unit, fuel manifold valve, fuel discharge nozzle), carburetor icing (vaporization, laws of evaporation, carburetor ice formation, carburetor intake heating, effect of ice on engine performance, carburetor induction system (alternate air, air filter, intake blockage indication and symptoms).
 - 3.1.8 Engine instruments: rpm, manifold pressure, oil pressure, oil temperature, cylinder head temperature, exhaust gas temperature, fuel flow and pressure, induction system temperature.
 - 3.1.9 Engine controls: throttle, rpm, mixture, carburetor heat, cowl flap, ignition switch, engine priming pump and prime switch, alternate air.

- 3.1.10 Engine handling: pre-start inspection, starting procedure and precautions, shut down procedure, after start checks and testing, procedure for changing power settings.
- 3.1.11 Engine performance: manifold pressure versus rpm, propeller load, effect of altitude/temperature on performance, effects of fuel/air ratio, best power, best economy, carburetor air temperature, exhaust back pressure, cruise control (range and speed charts, power settings).
- 3.1.12 Propellers: reason for variable/constant speed propellers, blade pitch positions (flight fine pitch, ground fine pitch, coarse pitch, feather, reverse pitch), propeller efficiency, construction and operation (single acting propeller, double acting propeller), constant speed unit (over-speed, under-speed, feather/unfeather, synchronization, synchrophase), design features for power absorption.

3.2. **Turbine engines**

- 3.2.1 Basic principles: theory of jet propulsion (Newton's laws of motion), working cycle (gas flow, changes in pressure, velocity, temperature, constant pressure cycle).
- 3.2.2 Engine construction: intakes(subsonic), compressors (centrifugal, axial, spool arrangements-single/twin/triple), compressor characteristics, effects of blade damage and deterioration), combustion systems (multichamber, turbo-annular, annular, air fuel ratios, turbines single/twin/triple spool, impulse/reaction, exhausts (collectors, jet pipe, propelling nozzles, pressure thrust, methods of noise reduction), external gearbox (drives, accessories), schematic construction and functioning.

3.3. **Supercharging**

- 3.3.1 Purpose of supercharging;
- 3.3.2 Types of superchargers:
 - 3.3.2 .1. Geared (mechanically driven)
 - 3.3.2 .2. Turbo (exhaust driven)
- 3.3.3 Purpose / function of the following components
 - 3.3.3 .1. Geared superchargers:
 - 1) impeller, diffuser;
 - 3.3.3 .2. Turbo chargers:
 - 1) compressor, waste gate fixed, manual, automatic;
- 3.3.4 Precautions to be observed to avoid detonation when operating a supercharged engine.

3.4. **Power Plants**

- 3.4.1 The term "full throttle height".
- 3.4.2 Effect of the following factors on engine performance
 - 3.4.2 .1. Fuel / air mixture strength;

3.4.2 .2. Density height;

3.4.2 .3. Altitude, on:

- 1) Normally aspirated engines;
- 2) Turbocharged / supercharged engines.

3.4.3 Performance characteristics of:

3.4.3 .1. Aeroplanes with fixed pitch propellers and those fitted with a CSU;

3.4.3 .2. Engine operation (within limits) at high MP / low RPM and low MP / high RPM;

3.4.3 .3. Normally aspirated and turbocharged / supercharged engines;

3.5. **Aeroplane Systems**

3.5.1 Function of the following typical components mentioned in pilot operating handbooks

3.5.1 .1. **Fuel system and fuels**

- 1) Fuel system components:
 - a. auxiliary / booster pump;
 - b. fuel drain;
 - c. fuel pressure gauge;
 - d. fuel flow gauge;
 - e. Check valves.
- 2) Fuel types, Colour / Properties
- 3) Density / Weight
- 4) Additives
- 5) Contamination and Deterioration
- 6) Tank Location
- 7) Venting / Baffling
- 8) Fuel Lines - Filters / Drains
- 9) Induction Manifold
- 10) Detonation / Pre-ignition - Causes / Effects
- 11) Vapour Lock
- 12) Fuel Heater
- 13) Primers
- 14) Fuel Management - Ground /Air

15) Fuel Handling - Fueling Aircraft,

16) Grounding / Bonding

3.5.1 .2. Lubricating Systems and Oils:

1) Methods of Lubrication;

2) Venting;

3) Dilution;

4) Oil Cooler;

5) Filters;

6) Pressure Relief and by-pass valves

7) Wet sump system;

8) Dip stick;

9) Types - Viscosity / Grades / Seasonal Use;

10) Purposes;

3.5.1 .3. Electrical & Ignition systems:

1) Alternator; generators;

2) Voltage regulator; over voltage relay;

3) Ammeter; voltmeter;

4) Circuit breaker; fuse;

5) Battery; ampere hours;

6) Bus bar; battery master switch;

7) Starter motor; distributor; ignition switch;

8) Dual ignition;

9) External power receptacle, ground / flight switch;

3.5.1 .4. Stall warning devices

3.5.1 .5. Undercarriage system:

1) Oleos / shock struts;

2) Shimmy dampers;

3) Nose wheel steering / castering;

4) Retractable undercarriage;

a. Up-lock / down locks

b. anti-retraction devices

c. aural / visual warning devices

- d. emergency systems
- e. free fall, electric, hydraulic, pneumatic;

3.5.1 .6. **Hydraulic system:**

- 1) Accumulator;
- 2) Actuators;
- 3) Brake master cylinder;
- 4) Check valve; restrictors;
- 5)

3.5.1 .7. **Auto-Pilot:**

- 1) Roll, attitude, heading, pitch controls
- 2) Trim indicator
- 3) Cut-Out Mechanisms
- 4) Auto Thrust (includes the possibility of enable overpowering the system and associated precautions)

3.5.1 .8. **Recorders:**

- 1) Cockpit Voice Recorder
- 2) Flight Data Recorder
- 3) Ground Proximity warning system and data recorder

3.5.1 .9. **Fire protection:**

- 1) Typical detectors:
 - a. overheat - thermal switches
 - b. rate of temperature rise – thermocouple
 - c. flame;
- 2) Typical warning devices:
 - a. lights
 - b. audio;
- 3) Types of fire extinguisher and usage,
- 4) Engine cooling;
 - a. fins
 - b. baffles
 - c. cowl flaps

3.5.1 .10. Oxygen system and emergency equipments.

3.6. **Flight Instruments:**

3.6.1 General

3.6.1 .1. Pitot-static system;

3.6.1 .2. Pitot pressure; static pressure;

3.6.1 .3. Alternate static source;

3.6.1 .4. Pressure error;

3.6.2 Relationship between: IAS, CAS; EAS; TAS, MACH NO.

3.6.3 Basic knowledge of the principle of operation and construction of the;

3.6.3 .1. ASI, VSI, altimeter;

3.6.3 .2. Artificial horizon, direction indicator, rate of turn indicator turns coordinator.

3.6.3 .3. Effect of the following factors on the accuracy pressure instrument indications:

1) ASI:

a. Blockage / leaks (pitot or static);

b. Maneuver induced errors (e.g. sharp pull out from a dive);/other errors

2) VSI:

a. Blockage of the static source;

b. Lag;

3) Altimeter:

a. Blockage of the static source;

b. Lag;

c. Incorrect sub-scale settings;

d. Errors due to changes in atmospheric temperature and pressure.

3.6.3 .4. Gyroscopic principles

1) Gyroscopic properties of rigidity and precession;

2) Advantages and disadvantages of air driven and electrically driven gyroscopes;

3) On a Directional Indicator of:

a. apparent wander / drift (maximum at the poles, zero at the equator)

b. transport wander.

3.6.3 .5. Direct reading magnetic compass principle of construction:

- 1) magnetic needles point to magnetic north
- 2) fluid decreases oscillations and friction - should not contain air bubbles
- 3) pendulosity of magnet system causes errors.

3.6.3 .6. Effect of the following errors on compass indication in the northern / southern hemisphere:

- 1) Turning errors;
- 2) Acceleration errors.

3.6.3 .7. Purpose and use of a compass correction card to determine magnetic heading.

3.7. **Radio Aids:**

3.7.1 Basic principles and definitions of radio wave propagation and recall the appropriate frequency bands for VHP, MF and HF.

3.7.2 Limitations of VHF and HF in terms of quality of reception and range.

3.7.3 Factors which may affect VHF and HF reception.

3.7.4 Use of appropriate charts/documents to:

3.7.4 .1. Extract VHF and HF frequencies;

3.7.4 .2. Determine communication coverage.

3.8. **Transponder:**

3.8.1 Precautions to be observed when selecting codes and transponder codes for:

3.8.1 .1. Radio failure;

3.8.1 .2. An emergency;

3.8.1 .3. Hi-jack.

3.8.2 Meaning of the terms SQUAWK, IDENT and CODE.

3.8.3 Information (if any) that is transmitted when a pilot selects:

3.8.3 .1. STBY, ON;

3.8.3 .2. ALT, IDENT.

3.8.4 Indications of normal and abnormal transponder operation and factors which affect transponder reception.

4. **FLIGHT RULES & AIR LAW**

4.1. **Documentation**

4.1.1 Given an item of operational significance:

- 4.1.1 .1. Be able to select the appropriate reference document and
- 4.1.1 .2. Extract relevant and current information.
- 4.1.2 Extract / decode information contained in NOTAMS and AIP.
- 4.1.3 Understand the terms and abbreviations in AIP GEN, which are relevant to VFR operations.
- 4.1.4 Knowledge and complete understanding of CAR's and ANOs applicable to a PIC and a Licence holder.
- 4.1.5 International and National Aviation Law;
 - 4.1.5 .1. Brief History
 - 4.1.5 .2. Chicago convention
 - 4.1.5 .3. Annexes to convention on International Civil Aviation
 - 4.1.5 .4. Standards and recommended practices
 - 4.1.5 .5. National Laws regulations governing Civil Aviation
- 4.1.6 Including Following Essential Rules;
 - 4.1.6 .1. Essential Definitions
 - 4.1.6 .2. General rules, purpose, protection of persons and property safety of flight, avoidance of collision, Enumerate basic rules of air
 - 4.1.6 .3. CAR's
 - 4.1.6 .4. Visual Flight Rules including weather requirements important features of VFR, thorough understanding of VFR
 - 4.1.6 .5. Instrument Flight Rules including weather requirements important features of IFR through understanding of IFR
- 4.1.7 Distress and urgency signals;
 - 4.1.7 .1. Red rockets or shells, red flare
 - 4.1.7 .2. Repeated switching on / off landing lights or navigation lights
 - 4.1.7 .3. Observing / understanding of such signals
- 4.1.8 Signals for Aerodrome traffic;
 - 4.1.8 .1. Light signals
 - 4.1.8 .2. Pyrotechnics
 - 4.1.8 .3. Visual signals of acknowledgement by aircraft
- 4.1.9 Ground signals;
 - 4.1.9 .1. Signals like direction of traffic closed runways and taxiways etc
 - 4.1.9 .2. Marshalling signals

- 4.1.10 Markings;
 - 4.1.10 .1. Runways, centerline, threshold, touchdown
 - 4.1.10 .2. Taxiways ,
 - 4.1.10 .3. Unpaved Areas
- 4.1.11 Flight Plans;
 - 4.1.11 .1. Types of flight plan
 - 4.1.11 .2. How to file a flight plan
 - 4.1.11 .3. Contents of flight plan
 - 4.1.11 .4. Adherence to flight plan
 - 4.1.11 .5. Closing a flight plan
- 4.1.12 ICAO ANNEX -13 (For Reports)
 - 4.1.12 .1. Definitions ICAO Annex-13 (Accidents / incidents)
 - 4.1.12 .2. Air miss Report
 - 4.1.12 .3. Other reports like technical incidents, hard landing, exceeding limitations damage to aircraft, person, property
 - 4.1.12 .4. Responsibility for notifying
 - 4.1.12 .5. To whom notifications are made
 - 4.1.12 .6. Contents / format / procedures for notification
- 4.1.13 Essential Documents
 - 4.1.13 .1. Registration of Aircraft
 - 4.1.13 .2. Certificate of Airworthiness
 - 4.1.13 .3. Documents required on board on Aircraft as per rules
- 4.1.14 Rules Relating to cross - country flight
 - 4.1.14 .1. Rules of avoiding collision
 - 4.1.14 .2. Aerodromes used for local cross country flight
 - 4.1.14 .3. Enroute procedures
 - 4.1.14 .4. Filing a flight plan
- 4.1.15 Search and Rescue Procedures
 - 4.1.15 .1. Organization Resources
 - 4.1.15 .2. Action required for pilots in distress
 - 4.1.15 .3. Action pay survivors
- 4.1.16 General Provision of Air Law

- 4.1.16 .1. Types of aviation operation
- 4.1.16 .2. Law requirements for selected activities and equipments / Flight data recorders, cockpit voice recorders, transport of dangerous goods, oxygen equipment and its use, restriction on smoking a board aircraft, dropping articles from aircraft
- 4.1.17 Flight Time Limitation
 - 4.1.17 .1. Introduction to Air traffic services
 - 4.1.17 .2. Avoidance of fatigue
 - 4.1.17 .3. Maximum permissible duty period and flight time
 - 4.1.17 .4. Rest periods
- 4.1.18 Air Traffic Services
 - 4.1.18 .1. Introduction to Air traffic services
 - 4.1.18 .2. Aeronautical Information Services
 - 4.1.18 .3. Aerodrome Control
 - 4.1.18 .4. Air Traffic Control
 - 4.1.18 .5. Obstruction clearance
 - 4.1.18 .6. Controlled airspace
 - 4.1.18 .7. Procedures for flight in controlled / uncontrolled airspace
- 4.1.19 Communication Procedures on VFR/IFR Flights
 - 4.1.19 .1. Simple aeroplane communication
 - 4.1.19 .2. Radiotelephony procedures
 - 4.1.19 .3. Local aerodrome R/T procedures
 - 4.1.19 .4. Messages
 - 4.1.19 .5. Communication failure during VFR flight
 - 4.1.19 .6. Distress and Urgency communication procedures
 - 4.1.19 .7. Communication failure during IFR flight
 - 4.1.19 .8. Communication during enroute /cross country flight
- 4.1.20 Aviation Medicine
 - 4.1.20 .1. Effect of illness and drug on flight
 - 4.1.20 .2. Aviation physiology I (Respiration)
 - 4.1.20 .3. Aviation physiology II (pressure changes)
 - 4.1.20 .4. Aviation physiology III (Disorientation)
 - 4.1.20 .5. First aid

- 4.1.20 .6. Fatigue
- 4.1.20 .7. Hygiene and survival
- 4.1.21 General Rules essential for Pilots
 - 4.1.21 .1. Aerodrome knowledge
 - 4.1.21 .2. Calculation of declared distances
 - 4.1.21 .3. Runway lighting systems
 - 4.1.21 .4. Liabilities towards persons and goods on ground
 - 4.1.21 .5. Applicability of the rules of air
 - 4.1.21 .6. Interception of civil aircraft
 - 4.1.21 .7. Signals (on ground/ In air /Aerodrome signals and markings/ Marshaller)
 - 4.1.21 .8. Tables of cruising levels
 - 4.1.21 .9. VFR (Visual Flight Rules)/ IFR (Instrument Flight Rules)
 - 4.1.21 .10. Search & Rescue
 - 4.1.21 .11. Flight plan for cross county flight & filing flight plan /validity of flight plan
 - 4.1.21 .12. Distress and emergency procedures.
- 4.1.22 Pilot licenses, privileges and limitations
 - 4.1.22 .1. As applicable to a GPL decide weather a flight can be conducted in accordance with the rules relating to:
 - 1) Privileges and limitations of the Licence;
 - 2) Recent experience requirements;
 - 3) Classification of operations.
 - 4.1.22 .2. Rules pertaining to flight and duty time limitations for:
 - 1) PPL holders
 - 2) CPL holders.
- 4.1.23 Flight rules and conditions of flight
 - 4.1.23 .1. Documents (hat must be carried on board an aircraft during flight
 - 4.1.23 .2. Rules relating to:
 - 1) Carriage of firearms and ammunition in Pakistan.
 - 2) Relevant information on aerodrome restrictions.
- 4.1.24 Air Service Operations
 - 4.1.24 .1. Extract of the rules relating to:

- 1) a pilot's responsibilities before conducting a flight
 - 2) VMC minima
 - 3) Flight over water
 - 4) Carriage of:
 - a. Cargo;
 - b. Floatation and survival equipment
 - c. Animals
 - d. Dangerous goods;
 - 5) Requirements for passenger manifest
- 4.1.24 .2. Requirements to test radio equipment prior to taxi and maintain a listening watch on appropriate frequency (AIP)
- 4.1.25 Aerodromes - Pilot's responsibilities with regards to the use of an aerodrome
- 4.1.26 Airspace & Air Traffic Services : General
- 4.1.26 .1. Various classifications of airspace.
 - 4.1.26 .2. With respect to the terms listed in (a) to (e) below, lateral and vertical limits of the designated airspaces from charts.
 - 1) Flight information service; FIR;
 - 2) Air traffic control service; CTA, TMA: CTR; ADZ
 - 3) Radio "reports" and "broadcasts";
 - 4) Prohibited, Restricted & Danger areas.
 - 5) Controlled aerodromes;
 - 4.1.26 .3. Requirements and procedures to be adopted when operating:
 - 1) In any class of airspace;
 - 2) From or to an aerodrome.
- Note:*
1. "Requirements" means the need for clearances, reports and broadcasts
 2. "Procedures" means when to request a clearance make a report/broadcast and pilot action on receipt of an instruction from A TC.
 3. This Topic does not include radio phraseology.
- 4.1.26 .4. Altimetry
- 1) The datum from which an altimeter indicates height

when the following are set on the sub-scale:

- a. regional QNH
 - b. QNH
 - c. QFE
 - d. Standards Pressure Setting
- 2) The meaning of the following:
- a. transition altitude
 - b. transition level
 - c. transition layer
- 3) Procedures that are carried out with the altimeter at the transition altitude and the transition level on climb and descent;
- 4) Extract from AIP about the transition level, transition altitude for any given aerodrome.

Note: In Pakistan, transition level for aerodromes are determined and published by appropriate ATS Authority.

4.1.27 Airworthiness & Equipment

- 4.1.27 .1. The purpose of certificates of air worthiness and registration
- 4.1.27 .2. The communication and normal and emergency equipment required onboard an aircraft.
- 4.1.27 .3. Responsibilities of a pilot-in-command with regard to:
 - 1) Daily inspections;
 - 2) Recording / reporting aircraft defects.
- 4.1.27 .4. As applicable, the types of maintenance that may be carried out by a CPL holder.
- 4.1.27 .5. Evaluation of maintenance release:
 - 1) Determination of its validity;
 - 2) The clauses of operation applicable to the aircraft.
 - 3) Outstanding defects / endorsements.

4.1.28 Emergencies, accidents, incidents

- 4.1.28 .1. Conditions under which a pilot may declare an emergency.
- 4.1.28 .2. Responsibilities of a pilot regarding the notification of accidents and incidents.

4.1.28 .3. Circumstances necessitate a call for priority landing.

4.1.29 Security

4.1.29 .1. The terms ADI2 and state:

- 1) The general requirements for operations in this zone; (AIP)
- 2) Signals initiated by intercepting aircraft and responses by intercepted aircraft (AIP).

5. **THEORY OF FLIGHT**

5.1. **Lift & Drag**

5.1.1 Definition and in-depth knowledge of the following and related terms:

5.1.1 .1. aerofoil; span, chord; camber; thickness/chord ratio

5.1.1 .2. relative airflow; angle of attack

5.1.1 .3. total reaction; lift; drag

5.1.1 .4. Laminar and turbulent boundary layers.

5.1.1 .5. Purpose of the following design features / controls:

- 1) anhedral; dihedral; aspect ratio; sweep back; washout
- 2) wing spoilers; flaps; vortex generators
- 3) trim tabs.

5.1.1 .6. Bernoulli's theorem of constant energy flow to describe how an aerofoil produces lift.

5.1.1 .7. Effect of changes in angle of attack up to the stalling angle on:

- 1) Pressure changes above and below the wing.
- 2) Changes in airflow characteristics; streamlined to turbulent.
- 3) Lift and drag;
- 4) The boundary layer

5.1.1 .8. Understanding of the following terms used in the lift and drag formulae viz.:

- 1) CL and CD - depend on shape and angle of attack of an aerofoil;
- 2) $1/2 PV_2$ - defines dynamic pressure (IAS);
- 3) S - defines surface area.

5.1.1 .9. With reference to Cl / Cd, graphs and angles of attack associated with:

- 1) Minimum drag - maximum level flight speed;

- 2) Max. Lift - stalling angle;
 - 3) Best cl / cd - best glide range and still air range.
- 5.1.1 .10. Types of drag and state the effect on total drag resulting from changes in IAS, aircraft weight and height.
- 5.1.2 Maneuvers
- 5.1.2 .1. The forces of lift, weight, thrust and drag acting on an aeroplane in:
- 1) a "steady" level flight;
 - 2) a "steady " climb;
 - 3) a "steady: descent;
 - 4) a balanced level turn.
- 5.1.2 .2. The relationship between speed, banks angle, radius and rate of turn during and balanced level turn.
- 5.1.2 .3. For a given IAS use the rule of thumb to determine the approximate bank angle for a rate one turn.
- 5.1.2 .4. Turn:
- 1) Power must be applied to maintain speed in a level turn;
 - 2) An aeroplane tends to overbank in level and climbing turns and not in descending turns.
- 5.1.3 Stalling and spinning
- 5.1.3 .1. Angle of attack
- 5.1.3 .2. Boundary layer and reasons for stalling.
- 5.1.3 .3. Variation of lift and drag in the stall.
- 5.1.3 .4. Movement of the centre of pressure
- 5.1.3 .5. Symptoms of the stall, stall detection (desirable characteristics)
- 5.1.3 .6. Tip stalling : dangers and methods off minimizing
- 5.1.3 .7. Stall warning devices
- 5.1.3 .8. Stall recovery
- 5.1.3 .9. Stalling speed variation: maneuvers, weight configuration
- 5.1.3 .10. The spin (autorotation)
- 5.1.4 Performance considerations
- 5.1.4 .1. For maximum still air range and endurance.
- 5.1.4 .2. Aerodynamic and engine considerations that are required to achieve maximum still air range and endurance when operating an aeroplane with:

- 1) Normally aspirated engine;
- 2) Turbocharged / supercharged engine.

5.1.4 .3. Power required and power available graphs:

- 1) Stall speed (power on);
- 2) Best still air range speed;
- 3) Best endurance speed;
- 4) Maximum level flight speed;
- 5) The region of reverse command.

Note: The region of reverse command is (sometimes) colloquially described as the "back of the power curve".

5.1.4 .4. The terms "load factor", "g" and "wing loading" and cite situations, which may result in aeroplanes exceeding load factor and wing loading limits.

5.1.4 .5. Certain flight conditions being constant, state the effect of:

- 1) Change in weight and altitude(height) on:
 - a. angle of attack and IAS in level flight;
 - b. level flight range and endurance;
 - c. turn rate and radius;
 - d. glide range and endurance;
- 2) change in head / tail wind component on:
 - a. level flight range and endurance;
 - b. glide range and endurance;
- 3) Change in power on turn rate and radius.

5.1.5 Stability and control

5.1.5 .1. Effect of the factors listed below on the stability and control of an aeroplane in each of the three planes of movement:

- 1) Longitudinal stability:
 - a. position of CG;
 - b. movement of centre of pressure;
 - c. changes in thrust;
 - d. tail plane movement;
- 2) Lateral stability
 - a. high versus low set wings;
 - b. dihedral versus anhedral;

- c. sweep back;
- 3) Directional stability
 - a. large fore / aft displacement of the CG;
 - b. Large versus small fin and rudder moment.

5.1.5 .2. Relationship between directional and lateral stability (spiral instability) and state the effect of spiral instability on the control of an aeroplane.

5.1.5 .3. Recognize statement / diagrams, which describe static and dynamic stability.

5.1.5 .4. Controllability problems associated with flight in the region of reverse command.

5.1.5 .5. The function of the following items in relation to the movement of a main control surface and the purpose of:

- 1) trim tabs (fixed and cockpit controlled);
- 2) balance tabs;
- 3) anti-balance tabs;
- 4) aerodynamic balance;
- 5) Mass balance.

5.1.6 Taxi, Take off and landing

5.1.6 .1. Stability and control characteristics of nose-wheel aeroplanes during ground operation.

5.1.6 .2. Result of the following factors on the controllability of an aeroplane:

- 1) Propeller torque and slipstream effect;
- 2) Gyroscopic effect;
- 3) Asymmetric blade effect.

5.1.6 .3. The term "ground effect" and its effect on aeroplane performance.

6. NAVIGATION

6.1. **Form of the earth:** In order to apply this knowledge a student should have an understanding of the items listed in (6.1.3.1.1.) to (6.1.3.1.9.) and their effect on:

- 6.1.1 position on the earth
- 6.1.2 time differences
- 6.1.3 distance and direction
 - 1) The shape and rotation of the earth;
 - 2) Latitude, longitude;

- 3) Meridians of longitude, parallels of latitude;
- 4) Equator, Greenwich meridian;
- 5) Great circles, small circles, rhumb lines;
- 6) Difference between true and magnetic north;
- 7) Terrestrial magnetism, magnetic variation and the change in variation with time;
- 8) Distance on the earth i.e. relationship between a minute of latitude and a nautical mile.
- 9) Convergency and conversion angle, definitions, formula and application.

6.2. **Time**

- 6.2.1 The terms UTC, Pakistan Standards Time.
- 6.2.2 Beginning and end of civil twilight from given sunrise and sunset times.
- 6.2.3 Carry out conversion between: UTC, Pakistan Standards Time.
- 6.2.4 Effect of the earth's rotation and revolution around the sun on the:
 - 6.2.4 .1. Beginning and end of daylight;
 - 6.2.4 .2. Period of daylight;
- 6.2.5 Effect of changes in longitude on local mean time.

6.3. **Charts and Publications**

- 6.3.1 Interpret topographic detail and decode symbols displayed on maps & charts.
- 6.3.2 On a map:
 - 6.3.2 .1. Measure rhumb line track;
 - 6.3.2 .2. Measure distance
 - 1) Using chart and latitude scale;
 - 6.3.2 .3. Plot a position given
 - 1) Latitude & longitude;
 - 2) Bearing & distance.

Note: Students should also practice techniques to estimate track and distance.

- 6.3.3 A CPL student is expected to have a basic knowledge of the theory of map projections and:
 - 6.3.3 .1. Identify the following properties of Lamberts conformal:
 - 1) Appearance of rhumb lines, great circles, meridians and the graticule;

- 2) Distortion of shapes and areas;
- 3) Scale variation;

6.3.3 .2. Describe the methods of representing scale.

6.4. **Computations** Review computation and conversions and:

- 6.4.1 Solve GS, distance, fuel required, fuel remaining and fuel consumption problems, given appropriate combinations of these factors;
- 6.4.2 Solve CAS/TAS problems given air temp & pressure height;
- 6.4.3 Determine HDG, GS and drift given TAS, W/V and TR;
- 6.4.4 Determine TR given HDG, TAS and W/V;
- 6.4.5 Solve problems relating to rates / gradients of climb and descent;
- 6.4.6 Determine TOPC and TOPD position using average airspeed, W/V, and rates of climb / descent.

6.5. **Pilot navigation**

- 6.5.1 Principles of map reading:
 - 6.5.1 .1. Method of chart orientation;
 - 6.5.1 .2. Situations when a pilot should read:
 - 1) From map to ground;
 - 2) From ground to map;
 - 6.5.1 .3. Selection of appropriate position lines to establish:
 - 1) Ground speed;
 - 2) Track error;
 - 3) Over mountainous terrain, coastal areas, densely populated and sparsely populated areas,
 - 6.5.1 .4. Selection of appropriate ground features to establish position when flying:
 - 1) At low level (500 ft AGL);
 - 2) Between (approximately) 2000 and 10,000 ft.;
 - 3) Over mountainous terrain, coastal areas, densely populated and sparsely populated areas.
- 6.5.2 Chart preparation and selection (practice): Draw tracks, track error lines, time / distance markings;
- 6.5.3 With reference to a planned or given track and given appropriate data:
 - 6.5.3 .1. Determine track made good (TMG);

- 6.5.3 .2. Calculation of drift;
- 6.5.3 .3. Determine alteration of heading or HDG (M) to:
 - 1) Parallel track;
 - 2) Intercept track at a nominated point;
 - 3) Track once track is intercepted;
- 6.5.3 .4. Calculation of estimates or ETA using latest ground speed or time / distance proportion;
- 6.5.3 .5. Establish a DR position using latest TR & GS.
- 6.5.3 .6. Application of one in sixty rule
- 6.5.3 .7. Mental revision of estimates (ETA's)
- 6.5.3 .8. Calculation of estimate TR & ETA to a selected diversion point.
- 6.5.4 Monitoring flight progress by maintaining an in-flight navigation log.
- 6.5.5 Monitoring fuel consumption and revise fuel reserves.
- 6.5.6 Plan in-flight diversions:
 - 6.5.6 .1. Around adverse weather;
 - 6.5.6 .2. To a suitable aerodrome.

Note: Diversions must address all appropriate items with respect to flight plan amendments.

6.6. **Radio navigation aids**

- 6.6.1 How to identify an aid and state the frequency of a nominated NDB or VOR.
- 6.6.2 Extract NDB and VOR information from and state the coverage of a VOR up to 10,000 ft.
- 6.6.3 The effect of the following errors on the reliability of ADF cockpit indications:
 - 6.6.3 .1. Mountain effect;
 - 6.6.3 .2. Effect of thunderstorms;
 - 6.6.3 .3. Coastal refraction.
- 6.6.4 The "aggregate" error of a VOR and explain what is meant by scalloping".
- 6.6.5 Establishing a position line given:
 - 6.6.5 .1. HDG & ADF data;
 - 6.6.5 .2. VOR indications.
- 6.6.6 Use of VOR to determine TR to or from a station.

- 6.6.7 Use of ADF or VOR to home to a station, and recognize instrument indications that signify station passage.
- 6.6.8 Establishing fixes using a DME distance and:
 - 6.6.8 .1. HDG & ADF data; or
 - 6.6.8 .2. VOR indications;
 - 6.6.8 .3. And use these fixes to make off track corrections.

7. AIRCRAFT OPERATION, PERFORMANCE AND PLANNING

7.1. Aeronautical Information Publication (AIP)

- 7.1.1 All items of information contained in AIP, which are relevant to VFR operations.

7.2. Aerodromes

- 7.2.1 Knowledge of the following terms: -
 - 7.2.1 .1. Take-off safety speed;
 - 7.2.1 .2. Take-off distance available (TODA);
 - 7.2.1 .3. Take-off distance required (TODR);
 - 7.2.1 .4. Landing distance available (IDA);
 - 7.2.1 .5. Landing distance required (LDR).

7.3. Density height: Calculation of density height:

- 7.3.1 Given OAT & pressure height;
- 7.3.2 Using cockpit temperature and an altimeter setting of 1013.2 hpa;
- 7.3.3 Density altitude charts.

Note: The following methods should be taught for (7.3.1) and (7.3.2):

A manual computer, Flight manual charts and/ or Mathematics.

7.4. Take off & landing performance

Note: "Completion Standards" and associated "Knowledge Standards" for CPL students are specified at the end of this topic.

- 7.4.1 Using the flight manual to extract maximum structural take-off and landing weights.
- 7.4.2 Use of performance charts to extract:
 - 7.4.2 .1. Maximum take-off weight;
 - 7.4.2 .2. Maximum landing weight;
 - 7.4.2 .3. Take-off distance required (TODR);
 - 7.4.2 .4. Landing distance required (LDR);

7.4.2 .5. Climb weight limit;

7.4.2 .6. Take-off parameters:

- 1) Power, flap setting, take-off safety speed;

7.4.2 .7. Landing parameters:

- 1) Flap, threshold speed; and state the conditions on which the parameters listed in (7.4.2.6) and (7.4.2.7) are based.

Note: The above objective will require the ability to perform one or more of the following tasks.

- a. *Determine TODA and LDA at an aerodrome.*
- b. *Extract / derive entry parameters for take off & landing charts viz:*
 - i) *Temperature and pressure;*
 - ii) *Take off and landing weights;*
- c. *Extract structural weight limits from a flight manual.*

CPL: *In addition to the requirement to conform to safety criteria, a student is also required to:*

- a. *Demonstrate speed and accuracy;*
- b. *Give reasons for imposing climb weight and structural weight limits;*
- c. *Calculate: Climb gradient and Rate of climb.*

7.5. **Climb, cruise and descent performance**

7.5.1 Typical charts or tables extracting the following data for climb, cruise and descent:

7.5.1 .1. Time, speed, distance, fuel flow / quantity;

7.5.1 .2. Appropriate engine settings;

7.5.1 .3. Rate of climb / descent;

7.5.1 .4. The conditions under which an aeroplane will achieve maximum range and endurance.

7.5.1 .5. Best air and ground NM / unit of fuel (e.g. 2.5 NM / Kg);

Note: Fuel units are US gal. kg, and liters.

7.5.2 Estimate:

7.5.2 .1. Mid zone weight;

7.5.2 .2. Landing weight;

7.5.2 .3. Take off weight at an intermediate landing point.

7.6. **Loading**

7.6.1 Complete knowledge of the following terms:

7.6.1 .1. Arm, moment, datum, station, index unit;

7.6.1 .2. Centre of gravity (CG) and CG limits;

7.6.1 .3. Mean aerodynamic chord (MAC);

7.6.1 .4. Empty weight, zero fuel weight (ZFW), ramp weight;

7.6.1 .5. Maximum take off and maximum landing weights;

7.6.1 .6. Floor loading limits.

7.6.2 Calculation of:

7.6.2 .1. CG as a % of MAC

7.6.2 .2. CG position relative to the datum;

7.6.2 .3. Movement of CG with changes in load distribution and mass.

7.6.2 .4. Extract the following weight limits from a flight manual:

1) Empty weight; ZFW;

2) Maximum structural take-off and landing weight;

7.6.2 .5. Determine:

1) maximum payload

2) maximum load per station

3) maximum floor loading capacities

4) Fore and aft CG limits for a given / derived weight

5) Weight of fuel / ballast to be carried.

7.6.3 Given appropriate data use a typical loading system or load sheet to distribute load to maintain CG within limits throughout the flight.

CPL: In addition to the safety standards specified for a CPL, student is required to:

Demonstrate speed and accuracy as defined in knowledge tests / examinations;

Determine:

a) The maximum payload / fuel that may be carried;

b) Ballast requirements if any;

c) The position of the CG under different load configurations.

7.7. **Flight plan preparation**

7.7.1 The responsibilities of a pilot-in-command with regard to weather and

operational briefing prior to planning a VFR flight;

7.7.2 Given a route applicable to the type of operation viz: CTA / FIR

7.7.2 .1. Select appropriate charts for the flight;

7.7.2 .2. Operations for which it is mandatory to obtain meteorological and operational briefing;

7.7.2 .3. Weather services available and nominated sources and methods of obtaining this information;

7.7.2 .4. AIP requirements for filing a flight plan for VFR flight.

7.7.3 Given an aerodrome forecast, determine whether holding or alternate requirements apply and if so:

7.7.3 .1. Nominate an appropriate alternate aerodrome; and

7.7.3 .2. Determine the quantity of additional fuel required for holding or flight to the alternate.

7.8. **Flight planning**

Note: Fuel policy of exam purposes will be recommended by ICAO.

CPL - completion standard

- 1) *Given a typical commercial task including:*
- 2) *Departure and landing points within and /or outside controlled airspace.*
- 3) *weather and operational briefing*
- 4) *appropriate performance data:*
- 5) *Selection of safe routes to comply with VFR;*
- 6) *Selection of cruise levels:*
 - a. *To comply with VFR and the table of cruising levels; and*
 - b. *Which meet passenger and fuel economy requirements;*
- 7) *Determine:*
 - a. *The minimum (safe) fuel required;*
 - b. *The maximum payload (passengers / cargo and fuel) that may be carried;*
 - c. *Whether intermediate refueling is necessary;*
 - d. *ETD/ETA after considering VFR requirements, flight/duty time limitations and commercial consideration;*
- 8) *Complete a Flight Plan form and a loading system.*

7.9. **Critical Point, Point of no return (PNR), Diversions**

- 7.9.1 Situations which may require the calculation of CP or PNR.
- 7.9.2 Assuming a constant cruise altitude and TAS, indicate the position of a CP between two points in still air.
- 7.9.3 Calculate time and distance to a CP or PNR between two points, using planned or given data.
- 7.9.4 Given fuel on board, use planned / given ground speed to decide which of the following courses of action would require the least fuel (including reserves):
 - 7.9.4 .1. Proceed to destination;
 - 7.9.4 .2. Return to the departure aerodrome;
 - 7.9.4 .3. Proceed to a suitable alternate;

Note: Also refer to Topic relating to diversion

8. **METEOROLOGY (I & II)**

The practical aspects of the knowledge

8.1. **Composition of the atmosphere**

- 8.1.1 Student should know the following vertical divisions in the atmosphere:
 - 8.1.1 .1. Troposphere, tropopause, stratosphere; and
 - 8.1.1 .2. That most weather effects occur below the stratosphere.
- 8.1.2 The standard atmosphere;
 - 8.1.2 .1. sea level temperature and pressure;
 - 8.1.2 .2. temperature and pressure lapse rates in the tropopause.

8.2. **Heat temperature, pressure and humidity**

- 8.2.1 A student should know: The method of measuring surface air temperature and that actual temperature may be much higher e.g. above a runway and Know the meaning of the following terms:
 - 8.2.1 .1. Isotherm, temperature inversion;
 - 8.2.1 .2. Radiation, advection, convection, conduction;
 - 8.2.1 .3. Isobar, horizontal pressure gradient;
 - 8.2.1 .4. Saturated air, relative humidity, dew point;
 - 8.2.1 .5. Evaporation, condensation, freezing.
- 8.2.2 The effect of changes in temperature, pressure and humidity on air density.
- 8.2.3 Factors that influence the diurnal variation of surface air temperature and explain the temperature gradient between land and sea surfaces.

8.3. **Atmospheric stability**

8.3.1 Differentiation of stable, unstable and conditionally atmospheric conditions.

8.4. **Clouds & precipitation**

8.4.1 Identify and "classify" cloud "types", classifications requirement are:

8.4.1 .1. high, medium, low

8.4.1 .2. cumuliform, stratiform, examples of "type" are Cu, Ci etc.

8.4.1 .3. Standard abbreviation for each cloud type, and the method used to report cloud amount.

8.4.1 .4. Weather associated with each cloud type.

8.4.1 .5. Differentiate between drizzle, rain, showers and virga.

8.4.1 .6. Select statements which describe the conditions necessary for the formation / dispersal of various types of cloud.

8.5. **Visibility**

8.5.1 Know the method used in meteorological forecasts and reports to determine visibility.

8.5.2 The term "runway visual range".

8.5.3 Reasons for differences between "in-flight" and "reported" visibility.

8.5.4 Meteorological factors which reduce in-flight visibility.

8.6. **Winds-General**

8.6.1 The relationship between pressure and wind and apply Buys Ballot' law to assess the approximate location of high and low-pressure systems.

8.6.2 Differentiation between:

8.6.2 .1. Squalls and gusts;

8.6.2 .2. Backing and veering.

8.6.3 Comparing between surface and gradient winds in terms of direction and strength.

8.6.4 "Factors" that effect the diurnal variation of wind and describe typical "variations" in surface wind strength during 24 hours period.

8.7. **Airmass and Fronts**

8.7.1 Cold fronts;

8.7.2 Warm fronts;

8.7.3 Wave depressions;

8.7.4 Occluded fronts;

8.7.5 Tropical cyclones;

- 8.7.6 The equatorial trough: With respect to
- 8.7.6 .1. temperature (warmer / colder)
 - 8.7.6 .2. wind changes (back / veer, stronger / weaker)
 - 8.7.6 .3. stability and turbulence
 - 8.7.6 .4. cloud type & approx. amount, precipitation

8.8. **Flight considerations**

- 8.8.1 With respect to the phenomena listed below:
- 8.8.1 .1. State the conditions favorable to their development and where applicable, their dispersal.
 - 8.8.1 .2. Recognize signs which may indicate their presence
 - 8.8.1 .3. describe their effect on flight characteristics
 - 8.8.1 .4. where applicable, state the pilot actions required to minimize their effect on an aircraft in flight:
 - 1) Thermals, turbulence;
 - 2) Dust devils and Dust storms;
 - 3) Wind gradient, wind shear and low level jet streams;
 - 4) An adiabatic and katabatic winds;
 - 5) Mountain waves and fohn winds;
 - 6) Land and sea breezes;
 - 7) Inversions and fog;
 - 8) Thunderstorms and micro bursts;
 - 9) Down drafts associated with terrain / cloud;
 - 10) Atmospheric stability and instability;
 - 11) Hoarfrost, rime, and clear airframe ice;
 - 12) Tropical cyclones, tornadoes;
 - 13) Meteorological aspects of altimetry, Pressure/density altitude -altimeter settings (Q-codes)

8.9. **Synoptic Meteorology**

- 8.9.1 Given a Mean Sea Level analysis chart, identify:
- 8.9.1 .1. High and low pressure systems;
 - 8.9.1 .2. A trough, a ridge, a col;
 - 8.9.1 .3. Warm, cold and occluded fronts;
 - 8.9.1 .4. A tropical cyclone;

8.9.1 .5. Approximate wind direction.

8.9.2 Describe typical weather characteristics associated with the items listed in 8.9.1. (8.9.1.1) & (8.9.1.2) above.

Note: *Items (8.9.1.3) and (8.9.1.4) are covered in 8.7. "Weather characteristics" means.*

1. *approx. wind direction*
2. *moisture content (dry / humid)*
3. *cloud: stratiform or cumuliform*
4. *clear skies*
5. *turbulent or smooth air*
6. *good or poor visibility*

8.10. **Weather services**

8.10.1 For given locations, extract from AIP the availability of forecasts, meteorological reports and weather briefing, and state the method of obtaining this information

Note: *Also included in Flight Planning*

8.10.2 Conditions under which It is mandatory to obtain a forecast.

8.10.3 Decode and apply information contained in an, METAR, SPECI, SIGMET, TAFOR, and LANDING FORECAST

Note: *Decode means the ability to:*

1. *Decide weather a particular forecast is valid for a flight.*
2. *Interpret any coded information into plain language.*

8.10.4 Given typical weather briefing, evaluate weather information applicable to a flight, and:

- 1) Assess likely changes in weather during the flight;
- 2) list phenomena which may adversely affect the flight.

8.10.5 The conditions which require a pilot to submit a short AIREP.

8.10.6 Purpose of VOLMET and ATIS broadcasts; indicate how this information is obtained; and apply this information to practical scenarios.

8.11. **Climatology**

8.11.1 Typical seasonal weather conditions in different regions of Indo-Pakistan.

8.11.1 .1. Visibility (good / poor)

8.11.1 .2. Prevailing winds;

8.11.1 .3. Typical cloud patterns and precipitation;

8.11.1 .4. Seasonal pressure and frontal system;

8.11.1 .5. Tropical cyclones.

9. **HUMAN PERFORMANCE AND LIMITATIONS**

9.1. **Basic Health**

9.1.1 Know the effect and importance on pilot performance of the following factors:

9.1.1 .1. Diet, exercise;

9.1.1 .2. Coronary risk factors – smoking, cholesterol, obesity, hereditary factors;

9.1.1 .3. Upper respiratory tract infection e.g. colds, hay fever, congestion of air passages and sinuses;

9.1.1 .4. Food poisoning and other digestive problems;

9.1.1 .5. Headaches and migraines;

9.1.1 .6. Pregnancy:

a. when to stop flying

b. impact on cockpit ergonomic;

9.1.1 .7. Injuries;

9.1.1 .8. ageing;

9.1.1 .9. Alcohol and smoking;

9.1.1 .10. Blood donations;

9.1.1 .11. Dehydration;

9.1.1 .12. Emotional:

a. Anxiety, depression, fears.

9.1.2 Know that a pilot is not to fly when on any medication unless a medical clearance from Medical Examiner has been obtained.

9.1.3 Know the responsibilities of pilots with regards to being medically fit for flight.

9.2. **Basic Human Factors**

9.2.1 Have a general concept of the factors which contribute towards fatigue and stress, and:

9.2.1 .1. State the effect of fatigue and stress on pilot performance;

9.2.1 .2. Know the basic principles of stress management and the methods used to cope with fatigue.

9.2.2 **Know the:**

9.2.2 .1. Reasons for and frequency of physical examinations and that a CAA network of Designated Aviation Medical Examiners exists;

9.2.2 .2. Process of obtaining a medical examination;

9.2.2.3. Role of the CAA with regard to medical fitness and that only those conditions that present a flight safety hazard are disqualifying.

9.2.3 Alcohol

9.2.3.1. Knowledge of how alcohol is absorbed and excreted;

9.2.3.2. State the factors that affect the elimination of alcohol from the body and describe the effects of illicit drugs and alcohol on proficiency e.g.;

- 1) Judgement, comprehension, attention to detail
- 2) The senses, co-ordination and reaction times.

9.2.4 Drug

9.2.4.1. Have a broad knowledge of the undesirable effects of over the counter and prescription drugs. In particular the side effects of:

- 1) aspirin, antihistamines, nasal decongestants
- 2) Amphetamines, tranquilizers, sedatives, antibiotics.

9.2.5 Blood donations

- 1) The effect on flying after giving a blood donation;
- 2) Recommended period between giving a blood and the next flight and know that this period can vary between individuals.

9.3. **Hypoxia / Hyperventilation**

9.3.1 Know how to recognize and combat.

9.3.2 Causes & its effects.

9.4. **Atmospheric Pressure Changes**

9.4.1 Trapped gases:

9.4.1.1. Know the effect of changes in pressure on gases trapped in the body cavities;

9.4.1.2. Effect on normal bodily function;

9.4.1.3. Measure for prevention / treatment.

9.4.2 Know the effects of flying after a period of underwater diving and the precautions to be taken if intending to fly after under water diving.

9.4.3 Basic knowledge of the Anatomy of the Ear

9.4.3.1. Know its function in receiving sound transmissions;

9.4.3.2. Purpose of the Eustachian tube and effects of atmospheric / cabin pressure changes;

9.4.3.3. The effects of noise exposure on:

- 1) hearing loss: long / short term
- 2) speech intelligibility
- 3) fatigue;

9.4.3 .4. Recommended methods of hearing protection.

9.5. **Vision, Spatial Disorientation, Illusions**

- 9.5.1 Have a basic knowledge of the notary of the eye and its function during the day and at night.
- 9.5.2 Know factors that affect night vision and identify methods of "dark adaptation".
- 9.5.3 Limitations of the eye in discerning objects at night and the "off-centre" method of identifying objects at night
- 9.5.4 Know the limitations of the eye with respect to:
 - 9.5.4 .1. The ability to discern objects during flight e.g., other aircraft, transmission lines etc.;
 - 9.5.4 .2. Empty field myopia;
 - 9.5.4 .3. Glare;
 - 9.5.4 .4. Colour vision in aviation;
 - 9.5.4 .5. Common visual problems, viz: Myopia, hyperopia, astigmatism, presbyopia.

9.6. **Human performance and limitations**

- 9.6.1 Human performance and limitations relevant to the Private / Commercial Pilot's Licence;
- 9.6.2 Principles of threat and error management;
- 9.7. A candidate whose Licence is lapsed for more than 6 months and not more than 24 months is required to pass PPL-R. If Licence lapse period is 24 months or more, he should appear for PPL paper Aeroplane and PPL-H for Helicopter Licence.

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates /training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner

APPENDIX "B"

COMMERCIAL PILOT LICENCE

1. COMMERCIAL PILOT LICENCE EXAMINATION

1.1. Type of Papers

- 1.1.1. Aircraft General Knowledge and Principles of Flight
- 1.1.2. Air Law, ATC Procedures and Operational Procedures
- 1.1.3. Meteorology and Flight Planning
- 1.1.4. Performance, Human Performance and Behavior
- 1.1.5. Mass & Balance and General Navigation
- 1.1.6. Radio Navigation and Instrumentation
- 1.1.7. Instrument Procedures
- 1.1.8. VFR and IFR Communication

1.2. CPL - Helicopters Examination : CPL-H

1.3. CPL - Revalidation Examination : CPL-R

1.4. **CPL** For the issue of Commercial Pilot Licence, a candidate shall pass written examinations of CPL:

- 1.4.1. Questions : 100
- 1.4.2. Pass percentage : 70%
- 1.4.3. Time allowed : 03:00 hours
- 1.4.4. Validity : 24 months

1.5. CPL-H

- 1.5.1. Questions : 50
- 1.5.2. Pass percentage : 70%
- 1.5.3. Time allowed : 01 hour 30 minutes
- 1.5.4. Validity : 24 months
- 1.5.5. Question Setting : Principles of Flight (Helicopter)

1.6. **CPL-R** For revalidation of lapsed Commercial Pilot Licence, a candidate shall pass written examination of paper CPL-R. paper CPL-R shall have:

- 1.6.1. Questions : 50
- 1.6.2. Pass percentage : 70%
- 1.6.3. Time allowed : 01 hour 30 minutes
- 1.6.4. Validity : 24 months
- 1.6.5. Question Setting : Flight Rules and Air law

- 1.7. **Syllabus** An applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a Commercial Pilot Licence and appropriate to the category of aircraft intended to be included in the licence. Topic wise details of CPL syllabus will be available in appendix A.
- 1.8. **Recommended Study Material**
- 1.8.1. AP 3456A Vol 'A': Principles of Flight
 - 1.8.2. FAA CPL Questionnaire: Gleim / ASA
 - 1.8.3. Basic Helicopter Handbook : ASA AC61-13B
 - 1.8.4. Safety in and around Helicopter : AC-91-32 USA
 - 1.8.5. Civil Aviation Rules 1994 (CARs 94)
 - 1.8.6. Aeronautical Information Publication (AIP)
 - 1.8.7. ICAO Annexe-2 (Rules of the Air)
 - 1.8.8. Commercial Pilot Manual: Jeppessen
 - 1.8.9. Trevor Thom Series for PPL/ CPL
 - 1.8.10. Private Pilots Manual: Jeppessen Sanderson Inc.
 - 1.8.11. Commercial Pilots Manual: Jeppessen
 - 1.8.12. From the Ground Up :Canadian

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates /training institutions may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the examiner

APPENDIX "C"

AIRLINE TRANSPORT PILOT LICENCE

1. Airline Transport Pilot Licence Examination

1.1. Type of Papers

- 1.1.1. Aircraft General Knowledge and Principles of Flight
- 1.1.2. Air Law, ATC Procedures and operational procedures
- 1.1.3. Meteorology and Flight Planning
- 1.1.4. Performance, Human Performance and Behavior
- 1.1.5. Mass & Balance and General Navigation
- 1.1.6. Radio navigation and Instrumentation
- 1.1.7. Instrument Procedures
- 1.1.8. VFR and IFR Communication

1.2 ATPL Helicopters Examination : ATPLH

1.3 ATPL Revalidation Examination : ATPL-R

1.4 ATPL

- 1.4.1 Questions : 100
- 1.4.2 Pass percentage : 70%
- 1.4.3 Time allowed : 03:00 hours
- 1.4.4 Validity : 36 months

1.5. ATPL-H

- 1.5.3. Questions : 50
- 1.5.4. Pass percentage : 70%
- 1.5.5. Time allowed : 01hour 30 minutes
- 1.5.6. Validity : 36 months
- 1.5.7. Question Setting : Principles of Flight (Helicopter)

1.6. ATPL-R

- 1.6.3. Questions : 50
- 1.6.4. Pass percentage : 70%
- 1.6.5. Time allowed : 01 hour 30 minutes
- 1.6.6. Validity : 36 months

1.7. Syllabus

The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of an Airline Transport Pilot Licence and appropriate to the category of aircraft intended to be included in the licence, in at least the following subjects:

TECHNICAL EXAMINATION SYLLABUS

1 Syllabus for examination for Airline Transport Pilot Licence is as follows:

- 1.1 Aircraft General Knowledge;
- 1.2 Flight Rules and Air law;
- 1.3 Flight Navigation;
- 1.4 Flight Performance and Planning;
- 1.5 Meteorology;
- 1.6 Human Performance and Limitations including threat & error management

2 A complete breakdown of approved theory examination syllabus is given below:

3 **AIRCRAFT GENERAL KNOWLEDGE**

- 3.1 Principles of flight, stability, control, flight maneuvers and lift augmentation devices
- 3.2 Principles of Flight and Flight Controls – Aeroplanes
 - 3.2.1 Definitions
 - 3.2.1.1 Components of aeroplane, stress terms, structural terms, material used, fatigue.
 - 3.2.1.2 Aeroplane configurations, definitions of shape and reference.
 - 3.2.1.3 Units of measurement: length, area, volume, velocity, mass, weight, pressure (static, dynamic, total), temperature, density, force, power, energy.
 - 3.2.1.4 Airspeeds. IAS, RAS/CAS, EAS, TAS, MACH Number.
 - 3.2.1.5 Reference speeds
 - 3.2.1.6 Terms used to describe aerodynamic phenomena. Boundary layer, laminar flow, turbulent flow, separated flow, ground effect.
 - 3.2.2 Derivation of lift
 - 3.2.2.1 Equation of continuity, mass flow
 - 3.2.2.2 Streamline flow
 - 3.2.2.3 Center of pressure, pitching moment

3.2.2.4 Wing shape (plan and section), effect on lift

3.2.3 Drag

3.2.3.1 Profile drag, causes, vortices, variation with speed, design factors affecting.

3.2.3.2 Induced drag; causes, vortices, variation with speed, design factors affecting.

3.2.3.3 Interference drag

3.2.3.4 Total effect of the combination of profile and induced drag.

3.2.3.5 Lift / drag ratio; variation with angle of attack, implications and operational considerations.

3.2.4 Distribution of forces, balance

3.2.4.1 Lift/weight and thrust/drag couples

3.2.4.2 Methods of achieving balance, CP/CG relationship, trim fuselage bending (tailplane loading)

3.2.4.3 Trim drag

3.2.4.4 Force and power situations in various phases of flight; thrust required/available, power required/available, take-off, manoeuvre, climb, cruise (range, endurance, propeller/jet), descent, landing,

3.2.4.5 Turning

3.2.4.6 Lateral force distribution, wing bending.

3.2.5 Stability

3.2.5.1 Aircraft axes and planes of rotation

3.2.5.2 Static stability

3.2.5.3 Dynamic stability

3.2.5.4 Effects of design features on stability: longitudinal, lateral, directional

3.2.5.5 Interaction between stability in different planes

3.2.5.6 Effect of altitude/speed on stability

3.2.5.7 Speed stability.

3.2.5.8 Yaw and roll

3.2.5.9 Auto-stabilisation, yaw and roll dampers, auto-throttle

3.2.5.10 Asymmetric effects

3.2.6 Stalling

3.2.6.1 Angle of attack

- 3.2.6.2 Boundary layer and reasons for stalling
- 3.2.6.3 Variation of lift and drag in the stall
- 3.2.6.4 Movement of the pressure
- 3.2.6.5 Symptoms of the stall, stall detection (desirable characteristics)
- 3.2.6.6 Tip stalling, dangers and methods of minimizing
- 3.2.6.7 Effect of separated flow over horizontal stabilizer, design configuration
- 3.2.6.8 Stall warning devices
- 3.2.6.9 Stall recovery Stick pushers
- 3.2.6.10 Stalling speed variation, manoeuvres, weight, configuration
- 3.2.6.11 The spin (automation)
- 3.2.7 Lift augmentation
 - 3.2.7.1 Trailing-edge devices: terminology, effects, advantages and disadvantages.
 - 3.2.7.2 Leading-edge device: terminology, effects, advantage and disadvantages
 - 3.2.7.3 Effect of lift augmentation devices on lift/drag ratio
 - 3.2.7.4 Flight deck controls and indicators
- 3.2.8 Flying controls
 - 3.2.8.1 Ailerons, elevators, rudder, spoilers/airbrakes, ailerons, flying tail, trimming tailplane, etc,
 - 3.2.8.2 Effects of primary, secondary and primary & secondary control surfaces
 - 3.2.8.3 Flutter, causes mass balance
 - 3.2.8.4 Actuation manual controls, aerodynamic balance and methods used, powered controls, methods of transmitting demands to control surfaces, feedback of control surface hinge moment, feel (natural/artificial), feel systems.
 - 3.2.8.5 Trim mechanical, aerodynamic, flight deck controls and indicators
- 3.2.9 Autopilots
 - 3.2.9.1 Function and application
 - 3.2.9.2 Types, different axes
 - 3.2.9.3 Component diagram
 - 3.2.9.4 Modes lateral, longitudinal, common
 - 3.2.9.5 System concepts for auto-land, go-around, take-off, fail

- passive, fail operational (redundant)
- 3.2.9.6 Control mode
- 3.2.9.7 System monitoring
- 3.2.10 Asymmetric flight
 - 3.2.10.1 Minimum control speeds
 - 3.2.10.2 Effect of ambient conditions
- 3.2.11 Propellers
 - 3.2.11.1 Conversion of engine torque to thrust
 - 3.2.11.2 Meaning of geometric pitch, effective pitch
 - 3.2.11.3 Angle of attack, blade angle
 - 3.2.11.4 Reasons for blade twist
 - 3.2.11.5 Propeller efficiency
 - 3.2.11.6 Wind milling drag
 - 3.2.11.7 Propeller effects, torque reaction, gyroscopic effect, asymmetric blade effect, slipstream effect
 - 3.2.11.8 Forces acting on a propeller, centrifugal twisting moment, aerodynamic twisting moment, thrust torque
 - 3.2.11.9 Fixed pitch propeller disadvantages
Materials, fatigue
- 3.2.12 Transonic flight
 - 3.2.12.1 Shock waves, the reasons for their formation at subsonic aircraft speeds, effect on handling and operation, sonic buffet and its similarity to aerodynamic stall, wave drag, merit, 'supercritical' terminology
- 3.2.13 Aerodynamic limitations
 - 3.2.13.1 IAS/EAS/TAS/M. dynamic pressure, margins
 - 3.2.13.2 Manoeuvring and gust envelope
- 3.2.14 Performance degradation
 - 3.2.14.1 Adverse effect on performance due to profile contamination including icing, rain, modification to and condition of the airframe
- 3.3 Advance / Highspeed Aerodynamics
 - 3.3.1 Compressibility theory
 - 3.3.2 Transonic changes in lift and drag
 - 3.3.3 Aircraft control and design at High speed.

- 3.3.4 Performance Aerodynamics
- 3.4 Engines, Turbine power-plants and associated systems
 - 3.4.1 Gas Turbine theory; engine structures such as intakes, compressors, combustion systems, turbines, exhausts.
 - 3.4.2 Turbofan engines.
 - 3.4.3 Turboprop engines
 - 3.4.4 Engine Instruments controls, performance, starting systems, APUs, thrust reversal and noise suppression devices
- 3.5 Piston and Gas Turbine Engines
 - 3.5.1 Piston engines
 - 3.5.1.1 Basic gas laws, Boyle's Law, Charts' Law
 - 3.5.1.2 Heat; conversion of heat energy to mechanical energy transfer of heat (conduction, convection, radiation)
 - 3.5.1.3 Power; unit of power (watt), horsepower (brake horse power, indicated horse power, thrust horse power, shaft horse power), factors which effect power output, controlling power output rpm/mp.
 - 3.5.1.4 Engine efficiencies: mechanical thermal, volumetric
 - 3.5.1.5 Power augmentation devices; turbo-charger, controllers wastegate, secondary effects of turbo-charging, supercharging
 - 3.5.2 Turbine engines
 - 3.5.2.1 Basic principles; theory of jet propulsion (Newton's laws of motion), working cycle (gas flow, changes in pressure, velocity, temperatures constant pressure cycle)
 - 3.5.2.2 Engine development, engine efficiencies (propulsive, thermal, overall, basic mechanical arrangements (turbo-jets, turbo-props, turbo-shafts, by-pass engines, spool arrangements single/twin/triple), relative propulsive efficiencies (advantages/disadvantages, mechanical arrangement).
 - 3.5.2.3 Engine construction; intake (subsonic), compressors (centrifugal, axial, spool arrangements- single /twin / triple, compressor characteristics, effects of blade damage and deterioration), combustion systems (multichamber, tubo-annular, annular, air fuel ratios, cooling and dilution flows, method of "atomization and vaporization), turbines [single twin / triple spool, impulse / reaction, shrouding / unshrouding, active clearance control, blade and disc cooling, creep/thermal fatigue/thermal shock, free power turbines) exhausts (collectors, jet pipe, propelling nozzles, pressure thrust, methods of noise reduction, external gearbox (drives, accessories) schematic construction and functioning
- 3.6 Aircraft Systems

- 3.6.1 Flight Control Systems including Automatic Pilot Control Systems
- 3.6.2 Flight Instruments and Management Systems i.e., EFIS, FMS.
- 3.6.3 Electrical Systems.
- 3.6.4 Fuel and Oil Systems.
- 3.6.5 Landing gear, braking / antiskid systems.
- 3.6.6 Air-conditioning, Cabin pressurization and Oxygen systems.
- 3.6.7 Hydraulic and Pneumatic actuating systems
- 3.6.8 Ice and rain protection systems.
- 3.6.9 Warning and recording systems such as.
 - 3.6.9.1 GPWS.
 - 3.6.9.2 Stall/ overspeed warning systems
 - 3.6.9.3 TCAS
 - 3.6.9.4 Flight Data recording systems.
 - 3.6.9.5 Cockpit voice recording systems.
 - 3.6.9.6 Radars, Airborne weather radar, Transponder & ELT
- 3.6.10 Emergency equipment

4 **FLIGHT RULES AND AIRLAW**

- 4.1 Civil Aviation Rules'94;
 - 4.1.1 General Provisions
 - 4.1.1.1 Reckless or Negligent Operation of Aircraft
 - 4.1.1.2 Fitness of Flight Crew Members
 - 4.1.1.3 Alcohol or Drugs - Crew Members
 - 4.1.1.4 Alcohol or Drugs - Passengers
 - 4.1.1.5 Smoking
 - 4.1.1.6 Aircraft Operating Limitations
 - 4.1.1.7 Portable Electronic Devices
 - 4.1.1.8 Fuelling with Engines Running
 - 4.1.1.9 Starting and Ground Running of Aircraft Engines
 - 4.1.1.10 Aircraft Icing
 - 4.1.1.11 Flight over Built-up Areas or open-air Assemblies of Persons during Take-off, Approaches and Landing within Built-up Areas of Cities and Towns
 - 4.1.1.12 Take-off, Approaches and Landings within Built-up Areas of

Cities and Towns

- 4.1.1.13 Minimum Altitudes and Distances
- 4.1.1.14 Permissible Low Altitude Flight
- 4.1.1.15 Right-of-way - General
- 4.1.1.16 Right-of-way - Aircraft maneuvering on ground
- 4.1.1.17 Avoidance of Collision
- 4.1.1.18 Towing
- 4.1.1.19 Dropping of Objects
- 4.1.1.20 Formation Flight
- 4.1.1.21 Entering or Leaving an Aircraft in Flight
- 4.1.1.22 Aerobatic Maneuvers - Prohibited Areas & Flight conditions
- 4.1.1.23 Aerobatics maneuvers with Passengers
- 4.1.1.24 Fuel Dumping
- 4.1.1.25 Compliance with Air Traffic Control instructions & clearances
- 4.1.1.26 Airspeed Limitations
- 4.1.1.27 Supersonic Flight
- 4.1.1.28 Cruising Altitudes and Cruising Flight levels
- 4.1.1.29 Altimeter setting and operating procedures in the Altimeter - setting region
- 4.1.1.30 Altimeter setting and operating procedures in the standard pressure region
- 4.1.1.31 Altimeter setting and operating procedures in transition between regions.
- 4.1.1.32 Landing at or Take-off from an Aerodrome at Night
- 4.1.1.33 Operational and Emergency Equipment Requirements
- 4.1.1.34 operating and Flight Rules
- 4.1.2 General Rules
 - 4.1.2.1 Privileges and responsibilities of a Licence holder and a PiC
 - 4.1.2.2 Flight and duty time limitation & rest period
 - 4.1.2.3 ICAO Annexes, adequate knowledge and understanding of rules of the air and procedures specified in ICAO publications. (Annex 1-18)
 - 4.1.2.4 Personnel Licensing requirements and privileges of an ATPL holder, recency and crediting of flight time acquired, Medical requirements

- 4.1.2.5 Aeronautical Information of Pakistan, Air Navigation Orders. Notams.
- 4.1.2.6 Jeppesen Airway Manual
- 4.1.2.7 Visual Flight rules and procedures.
- 4.1.2.8 Instrument flight rules and procedures

5 **FLIGHT NAVIGATION**

5.1 Form of Earth

- 5.1.1 The Earth
- 5.1.2 Form of the earth: rotation, great circles, small circles. rhumb lines and geographic poles
- 5.1.3 Position on earth latitude and longitude, use of co-ordinates to find position, difference of latitude and longitude
- 5.1.4 Direction on earth True north, magnetic north, compass north, grid north, variation, deviation, graviton. isogonals, isogrivs
- 5.1.5 Convergency and conversion angle definitions, formula, application
- 5.1.6 Distance on earth, units of measurement, (nautical miles, kilometers, statute miles), conversion, relationship to latitude.
- 5.1.7 Speed units of measurement (knots, mph, kilometers per hour), rectified airspeed, true airspeed, mach number relationship, groundspeed
- 5.1.8 Time distance, speed and time solutions

5.2 The Triangle of Velocities

- 5.2.1 Vectors, heading, track, drift. TAS, groundspeed
- 5.2.2 Computer solution
- 5.2.3 Multi drift wind velocities, wind components, maximum and minimum wind components for take-off and landing.

5.3 Navigation Systems and Approach Aids

- 5.3.1 Components, working and operation of,
 - 5.3.1.1 ADF / NDB
 - 5.3.1.2 DMF
 - 5.3.1.3 VOR / TACAN
 - 5.3.1.4 ILS
 - 5.3.1.5 GLOBAL NAVIGATION SYSTEMS (GPS)
 - 5.3.1.6 INS
 - 5.3.1.7 RNAV

5.3.1.8 MLS

5.3.1.9 PAPI/VASI

6 **FLIGHT PLANNING AND PERFORMANCE**

- 6.1 Operational flight planning; including preparation of operational flight plan and correct interpretation of information.
- 6.2 Practical use of charts/graphs and documents pertaining to aircraft performance.
 - 6.2.1 Terrain and obstacle clearance
 - 6.2.2 Cruising levels
 - 6.2.3 Computation of heading, ground speeds and times for tracks true airspeeds and wind velocities
 - 6.2.4 Use of wind component, tables for drift and groundspeed
 - 6.2.5 Fuel Plan
 - 6.2.6 Computation of planned fuel usage for each leg and total fuel
 - 6.2.7 Flight manual figures for fuel flow during climb, cruise, and descent Mid weights or instantaneous weights
 - 6.2.8 Total fuel requirements for flight
 - 6.2.9 Take off weight
 - 6.2.10 Landing weight
 - 6.2.11 Flight Monitoring and In-flight re-planning
 - 6.2.12 In-flight computations
 - 6.2.13 Comparison of actual and planned fuel consumption and fuel state, flight progress chart; PNR and CP
 - 6.2.13.1 Determination of aircraft gross weight in certain conditions/ configurations, fuel and payload calculations
 - 6.2.13.2 Limitations imposed on payload by (the effect of runway length, gradient and meteorological conditions.
 - 6.2.13.3 Use of aircraft performance data and meteorological data for the determination of optimum conditions for climb, cruise and descent and for PNR, still air range and CP.
- 6.3 Effect of failure of one or more power units on the PNR / CP and modification of the flight plan necessitated by such conditions e.g., selection of alternate route / aerodromes
- 6.4 Calculation of landing, take off and Accelerate stop distances and runway lengths required under various meteorological conditions. Landing comparison and thrust required graphs
- 6.5 Calculation and computation of CG, weight and moments, Index, allowable load. MAC, LEMAC weight & balance (load shift) adjustments

- 6.6 Determination of V1, VR, V2, landing speeds EPRs for cruise climb & descent / landing stab Trim settings, Fuel dump time, wind component computations with the help of graphs
- 6.7 Hydroplaning and wake turbulence landing techniques

7 **METEOROLOGY**

- 7.1 ATMOSPHERE, physical basis of meteorology, composition, characteristic of the atmosphere.
 - 7.1.1 Pressure, Temperature, Air density, moisture, lapse rates, stability and instability/humidity
 - 7.1.2 Clouds and Precipitation,
 - 7.1.3 Thunderstorms.
 - 7.1.4 Visibility & fog
 - 7.1.5 Icing.
 - 7.1.6 Winds, windshear, jetstream and turbulence
 - 7.1.7 Observation and measurement of meteorological elements (reports and forecasts)
 - 7.1.8 Synoptic meteorology; Airmasses, fronts, low pressure systems
 - 7.1.9 Upper winds
 - 7.1.10 Climatology
 - 7.1.11 Meteorological Organizations for International Air Navigation
 - 7.1.12 Sources of meteorological Information including meteorological broadcasts for aviation, in-flight weather reports, weather maps and prognostic charts
 - 7.1.13 Aeronautical meteorological coding and decoding such as station models, TAF, METAR, AIREPS SPECI etc.

8 **HUMAN PERFORMANCE & LIMITATIONS**

- 8.1 Aviation Physiology and effects of flight on Human body
 - 8.1.1 Hypoxia / Hyperventilation
 - 8.1.2 Gas Expansion Effects
 - 8.1.3 Decompression (including SCU8A diving)
 - 8.1.4 Vision / Visual Scanning Techniques
 - 8.1.5 Hearing
 - 8.1.6 Orientation/ Disorientation (Including visual and vestibular illusions)
 - 8.1.7 Positive and Negative "G"
 - 8.1.8 Circadian Rhythms/Jet Lag

- 8.1.9 Sleep /Fatigue
- 8.1.10 Human requirements for oxygen
- 8.2 The Pilot and The Operating Environment
 - 8.2.1 Personal Health / Exercise / Fitness
 - 8.2.2 Medications
 - 8.2.3 Substance Abuse (alcohol and drugs)
 - 8.2.4 Heat / Cold
 - 8.2.5 Noise / Vibration
 - 8.2.6 Effects of Smoking
 - 8.2.7 Hazards (including carbon monoxide)
- 8.3 Human performance including principles of threat and error management;

9 **Recommended Study Material:**

- 9.1 Handling Big Jets, D.P. Davies
- 9.2 Mechanics of Flight, AC Kermode
- 9.3 Air Pilot's Manual, (Vol. 4) T. Thom
- 9.4 Aircraft Systems & Integrated Systems, EHJ Pallett
- 9.5 Meteorology for Pilots, M. Wickson (Airlife)
- 9.6 ATPL Series, Trevor Thom (Vol, 1 – 4)
- 9.7 Ground Studies for Pilots, R.B. Underdown (Vol. 1 – 4)
- 9.8 Aircraft Systems for Pilots, D.D. Remer
- 9.9 Human factors for Aviation, Air Transport Canada
- 9.10 ATPL Questionnaire, Gleim / ASA
- 9.11 Jeppessen Airway Manual
- 9.12 CARs 94, AIP, ANOs, ICAO Annexes.

Note: 1. A candidate whose ATPL is lapsed more than 6 months shall Pass paper ATPL-R and when the lapse period is more than 24 months, he shall pass paper ATPL-1. For revalidation of Helicopter Licence he shall also pass paper ATPL-H.

Note: 2. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates / training organizations may select any suitable publication.

Note: 3. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner.

INSTRUMENT RATING

1. INSTRUMENT RATING EXAMINATION IR

1.1. Type of Papers

1.1.1. Instrument Rating Examination : IR

1.1.2. Instrument Rating Revalidation Examination : IR-R

1.2. **IR** For the issue of Instrument Rating a candidate shall pass written examination of paper IR. IR paper shall have :-

1.2.1. Questions : 100

1.2.2. Pass percentage : 70%

1.2.3. Time allowed : 03: 00 hours

1.2.4. Validity : 24 months

1.3. **IR-R** For the revalidation of Instrument Rating a candidate shall pass written Examination of paper IR-R Paper IR-R shall have :

1.3.1. Questions : 50

1.3.2. Pass percentage : 70%

1.3.3. Time allowed : 01 hour 30 minutes

1.3.4. Validity : 24 months

1.3.5. Question Setting : Aviation Law, Instrument Flight Rules & Procedures

INSTRUMENT RATING

TECHNICAL EXAMINATION SYLLABUS

1 The applicant shall have demonstrated a level of knowledge a Syllabus for examination for Instrument Rating is as follows:

1.1 Aircraft Instrument

1.2 Radio Aids / Radio Aids to Navigation

1.3 Instrument Flight Rules

2 A complete breakdown of approved theory examination syllabus is given below:

3 **AIRCRAFT INSTRUMENTS**

3.1 Air Data sources

3.1.1 International standard atmosphere, basic concepts and description.

3.1.2 Construction, principle of operations and error of the following:

- 3.1.2.1 Pitot Tube
- 3.1.2.2 Static source / system
- 3.1.2.3 Alternate static source
- 3.1.2.4 Combined pressure head.
- 3.2 Pressure Instruments
 - 3.2.1 Altimeter
 - 3.2.1.1 Basic principles, construction and operation.
 - 3.2.1.2 Error and effect of blockages.
 - 3.2.1.3 Calibration
 - 3.2.1.4 Pressure settings and effect of non standard temperature
 - 3.2.1.5 Conversion of indicated to true altitude.
 - 3.2.2 Airspeed Indicator
 - 3.2.2.1 Principle of operations and construction
 - 3.2.2.2 Ram and Dynamic pressure
 - 3.2.2.3 Calibration and error
 - 3.2.2.4 Blockages and speed terms such as EAS, RAS/CAS, TAS, IAS Mach No. and their calculation / conversions.
 - 3.2.3 Vertical Speed Indicator
 - 3.2.3.1 Basic principles, construction and operation.
 - 3.2.3.2 Errors
 - 3.2.3.3 Effects of Blockages.
 - 3.2.4 Mach Meter
 - 3.2.4.1 Theoretical principles and construction
 - 3.2.4.2 Advantages over ASI and its error
 - 3.2.4.3 Conversion of Mach Number. To True Airspeed.
- 3.3 Gyroscopic Instruments
 - 3.3.1 Gyroscope and its properties of rigidity and precession.
 - 3.3.2 Type of gyroscope, gyrowander and gyroscopic power sources.
 - 3.3.3 Description, general principles, methods of operation, limitation and errors of the following instruments.
 - 3.3.3.1 Artificial Horizon
 - 3.3.3.2 Directional Gyro/ Directional Indicator.
 - 3.3.3.3 Rate of turn indicator.

- 3.3.3.4 Gyrosyn Compass.
- 3.3.3.5 HIS/ RMI.
- 3.4 **Magnetism and Compasses**
 - 3.4.1 Principles of Magnetism
 - 3.4.2 Basic concept and knowledge of;
 - 3.4.2.1 Terrestrial magnetism, earth magnetic fields, directive force, magnetic dip, variation and aircraft magnetism.
 - 3.4.2.2 Deviation effects, change with heading and latitude.
 - 3.4.2.3 Compass swing, procedure and occasions when it is required.
 - 3.4.2.4 Types of compasses and their construction.
 - 3.4.2.5 Acceleration and turning errors.
- 4 **RADIO AIDS**
 - 4.1 Theory of propagation
 - 4.1.1 Principles of Radio signal transmission and reception
 - 4.1.2 Properties of Radio waves
 - 4.1.3 Concepts of speed of propagation, frequency, wavelength, phase, phase difference and frequency band.
 - 4.1.4 Concept and knowledge of;
 - 4.1.4.1 Signal generation, feeding and emission on RF signal in radio transmitter.
 - 4.1.4.2 Characteristics, polarization and use of antennas
 - 4.1.4.3 Amplitude, frequency and pulse modulation
 - 4.1.4.4 Factors affecting range and propagation of ground, direct and sky waves and height of ionosphere layers,
 - 4.1.4.5 Long and short range communication system.
 - 4.2 Radio Aids to Navigation
 - 4.2.1 Principles of operation, components, working, coverage and range errors and accuracy of the following:
 - 4.2.1.1 Ground D/F
 - 4.2.1.2 ADF/NDB
 - 4.2.1.2.1 NDB/ADF Combination
 - 4.2.1.2.2 NDB details and broadcasting
 - 4.2.1.2.3 ADF Components and principles

- 4.2.1.2.4 Different types of ADF indicators
- 4.2.1.2.5 Using the ADF to obtain position lines from an NDB.
- 4.2.1.2.6 Using the RBI (fixed card ADF)
- 4.2.1.2.7 Using the RMI (Rotateable card ADF)
- 4.2.1.2.8 Tracking procedures using the ADF
- 4.2.1.2.9 Limitation and accuracy of the NDB/ADF combination.
- 4.2.1.2.10 Overall accuracy of NDB/ADF combination
- 4.2.1.2.11 Construction and basic principles of NDB and ADF.
- 4.2.1.3 VOR
 - 4.2.1.3.1 Introduction
 - 4.2.1.3.2 Types of VOR Ground system
 - 4.2.1.3.3 Airborne equipment
 - 4.2.1.3.4 Operation of the VOR
 - 4.2.1.3.5 Orientation using the VOR and how to find a position line
 - 4.2.1.3.6 Tracking procedures with a VOR
 - 4.2.1.3.7 Limitation of the VOR
 - 4.2.1.3.8 Doppler VOR
 - 4.2.1.3.9 Construction and basic principles of VOR
- 4.2.1.4 Overall accuracy of ADB/ADF system
- 4.2.1.5 VOR/DME Area Navigation (RNAV)
 - 4.2.1.5.1 Introduction
 - 4.2.1.5.2 Types of DME System
 - 4.2.1.5.3 Where to find details of a DME
 - 4.2.1.5.4 DME operations principles
 - 4.2.1.5.5 Position fixing with the DME
 - 4.2.1.5.6 Tracking a beam of DME Ground station.
- 4.2.1.6 Radio Altimeter
- 4.2.1.7 Microwave Landing System
- 4.2.1.8 Basic knowledge of GPS/INS
- 4.2.1.9 Basic principles and knowledge of GPWS and TCAS, EFIS, FMS.

- 4.2.1.10 Altitude alert system
- 4.2.1.11 Hyperbolic Navigation system
- 4.2.1.12 ILS 9(Construction/ principles of ILS/ categories of ILS)
- 4.2.2 Basic radar principles, advantages and disadvantages of primary / secondary radar including elementary definitions.
- 4.2.3 S.S.R. and its applications
- 4.2.4 Principles, coverage / range of ground and airborne weather radar.

5 INSTRUMENT FLIGHT PROCEDURES

- 5.1 Principles of instrument flight including flight instrument system.
- 5.2 General provisions, rule of air, visual flight rules and instrument flight rules.
- 5.3 Airspace and IFR environment i.e.,
 - 5.3.1 FIRs, Advisory areas, Advisory routes, control zones, control areas, airways.
 - 5.3.2 Aerodrome and Approach lighting system
- 5.4
 - A) Practical use and knowledge of AIP, Jeppessen Airway Manual, NOTAMs and charts for instrument flight to determine facilities and restrictions for selected routes and aerodromes.
 - B) Practical use of essential documents for determining other minimas such as minimum equipment and fuel on board, crew composition, alternate aerodromes and weather minimas for selected and defined conditions of flight.
 - C) Civil Aviation rules 94 and ICAO Annexes.
 - D) Procedures in the event of partial and complete communication failure.
- 5.5 Altimeter setting procedures
- 5.6 Standard separation minimas
 - 5.6.1 Vertical and Horizontal separation with minimas.
 - 5.6.2 Radar separation minimas.
 - 5.6.3 Lateral separation minimas based on different navigation aids
- 5.7 Instrument Approaches
 - 5.7.1 ILS Approaches
 - 5.7.2 VOR/DME Approaches
 - 5.7.3 NDB Approaches

- 5.7.4 MLS Approaches
- 5.8 IFR operational considerations
 - 5.8.1 Standard instrument departures
 - 5.8.2 Enroute operations and IFR Navigation
 - 5.8.3 Arrival and Stars
 - 5.8.4 Arrival and departure procedures of aircraft.
 - 5.8.5 Approach procedures
 - 5.8.6 Holding procedures.
- 6 **Recommended Study Material**
 - 6.1 Instrument Rating Manual, jeppessen
 - 6.2 Ground Studies for Pilots
 - 6.3 Instrument Questionnaire
 - 6.4 Flight Briefing for Pilots, Birch 7 Branson
 - 6.5 Instrument Flying for Pilots, Trevor Thom

Note: 1. A candidate whose Licence had lapsed for more than 6 months and not more than 24 months, shall pass paper IR-R. Where a Licence lapse period is more than 24 months he shall pass paper IR.

Note: 2. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates / training organizations may select any suitable publication.

Note: 3. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner

INSTRUCTOR RATING

1. INSTRUCTOR RATING EXAMINATION

1.1. Type of Papers

1.1.1. Flight Instructor : FI

1.2.

1.2.1. Questions : 50

1.2.2. Pass percentage : 70%

1.2.3. Time allowed : 01 hour 30 minutes

1.2.4. Validity : 24 months

1.3. Question Setting

1.3.1. Testing, training philosophies, training program development, lesson planning, class room instructional techniques, management of flying schools, use of training aids, Analysis & correction of student errors, Hazards involved in simulating system failures and malfunctions in the aircraft.

1.4. Recommended Study Material

1.4.1. CARs 94, ANOs, ICAO Annexes

1.4.2. Flight Instructor's Handbook, FAA

1.4.3. Flight / Ground Instructor Questionnaire, Gliem / ASA

1.4.4. Flight Instructor Guide by Air Transport, Canada

1.4.5. Flight Instructor's Manual, Australian By Trevor Thom

1.4.6. Flight Instructor's Handbook, FAA

1.4.7. Flight / Ground Instructor Questionnaire, Gliem / ASA

1.4.8. Flight Instructor Guide by Air Transport Canada

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates /training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner

BALLOON PILOT LICENCE

1. BALLOON PILOT LICENCE EXAMINATION

1.1. Type of Papers

1.1.1. BPL Examination	:	BPL
1.1.2. Questions	:	100
1.1.3. Pass percentage	:	70%
1.1.4. Time allowed	:	03 hours
1.1.5. Validity	:	12 months

1.2. Question Setting

1.2.1. Aircraft General Knowledge (Airframes & Engines)	:	16%
1.2.2. Flight Rules and Air law	:	12%
1.2.3. Navigation	:	8%
1.2.4. Aircraft Operations	:	12%
1.2.5. Performance and Flight Planning	:	16%
1.2.6. Meteorology	:	16%
1.2.7. Theory of Flight	:	16%
1.2.8. Human Performance & Limitations	:	4 %.

1.3. Syllabus

The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a free balloon pilot Licence, in at least the following subjects.

1.3.1. Air Law

- 1.3.1.1. Rules and Regulations relevant to the holder of a free balloon pilot Licence; rules of the air; appropriate air traffic services practices and procedures;

1.3.2. Aircraft General Knowledge

- 1.3.2.1. principles of operation of free balloon systems and instruments;
- 1.3.2.2. operating limitations of free balloons; relevant operational information from the flight manual or other appropriate documents;
- 1.3.2.3. physical properties and practical application of gases used in free balloons;

1.3.3. Flight Performance and planning

- 1.3.3.1. Effects of loading on flight characteristics; mass calculations;
- 1.3.3.2. Use and practical application of launching, landing and other performance data, including the effect of temperature;

- 1.3.3.3. Pre-flight and en-route flight planning appropriate to operations under VFR; appropriate air traffic services procedures; altimeter setting procedures; operation in areas of high-density traffic;
- 1.3.4. **Human performance and limitations**
 - 1.3.4.1. Human performance and limitations relevant to the free balloon pilot; including principles of threats and errors management;
- 1.3.5. **Meteorology**
 - 1.3.5.1. Application of elementary aeronautical meteorology; use of, and procedures for obtaining, meteorological information; altimetry;
- 1.3.6. **Navigation**
 - 1.3.6.1. Practical aspects of air navigation and dead-reckoning techniques; use of aeronautical charts;
- 1.3.7. **Operational procedures**
 - 1.3.7.1. Use of aeronautical documentation such as AIP, NOTAM, aeronautical codes and abbreviations;
 - 1.3.7.2. Appropriate precautionary and emergency procedures, including action to be taken to avoid hazardous weather, wake turbulence and other operating hazards;
- 1.3.8. **Principles of flight**
 - 1.3.8.1. Principles of flight relating to free balloon;
- 1.3.9. **Radio telephony procedures**
 - 1.3.9.1. The application should have demonstrated a level of knowledge appropriate to the privileges to be granted to the holder of a free balloon pilot licence, in radiotelephony procedures and phraseology as appropriate to VFR operations and on action to take in case of communication failure.
- 1.4. **Recommended Study Material for BPL**
 - 1.4.1. Baloon Pilots Manual
 - 1.4.2. Trevor Thom Series for PPL
 - 1.4.3. Private Pilots Manual: Jepessen Sanderson Inc.
 - 1.4.4. From the ground up :Canadian
 - 1.4.5. CAR's 94
 - 1.4.6. AIP

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates / training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner.

MICROLIGHT COMPETENCY CERTIFICATE

1. MICROLIGHT COMPETENCY CERTIFICATE EXAMINATION

1.1. Type of Papers

- 1.1.1. MCC Examination : RCC
1.1.2. MCC Revalidation Examination : RCC-R

1.2. MCC

- 1.2.1. Questions : 100
1.2.2. Pass percentage : 70%
1.2.3. Time allowed : 03 hours
1.2.4. Validity : 24 months

1.3. Question Setting

- 1.3.1. Aircraft General Knowledge - Airframes & Engines : 16%
1.3.2. Flight Rules and Air law : 16%
1.3.3. Aircraft Operations : 16%
1.3.4. Performance and Flight Planning : 16%
1.3.5. Meteorology : 16%
1.3.6. Theory of Flight : 16%
1.3.7. Human Performance & Limitations : 4 %.

1.4. Recommended Study Material

- 1.4.1. The Ultralight Pilots Flight Training Manual (USUA publication)
1.4.2. Private Pilots Manual: Jepessen Inc.
1.4.3. From the ground up : Canadian
1.4.4. CAR's 94
1.4.5. AIP

MCC-Revalidation

- 1.4.6. Questions : 50
1.4.7. Pass percentage : 70%
1.4.8. Time allowed : 01 hour 30 minutes
1.4.9. Validity : 24 months
1.4.10. Question Setting : Flight Rules and Air law

1.4.11. Recommended study material : CARs 94 and Rule of the Air

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates / training institutions may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner.

GLIDER PILOT LICENCE

1. GLIDER PILOT LICENCE EXAMINATION

1.1. Type of Papers

- 1.1.1. GPL Examination : GPL-1
 1.1.2. GPL Instructor Rating (Technical Exam) : GPL-2
 1.1.3. GPL Revalidation Examination : GPL-R

1.2. GPL-1

- 1.2.1. Questions : 100
 1.2.2. Pass percentage : 70%
 1.2.3. Time allowed : 03 hours
 1.2.4. Validity : 12 months

1.3. Question Setting

- 1.3.1. Aircraft General Knowledge - Airframes & Engines : 16%
 1.3.2. Flight Rules and Air law : 16%
 1.3.3. Aircraft Operations : 16%
 1.3.4. Performance and Flight Planning : 16%
 1.3.5. Meteorology : 16%
 1.3.6. Theory of Flight : 16%
 1.3.7. Human Performance & Limitations : 4 %.

1.4. GPL-R

- 1.4.1. Questions : 50
 1.4.2. Pass percentage : 70%
 1.4.3. Time allowed : 01 hour 30 minutes
 1.4.4. Validity : 12 months
 1.4.5. Question Setting : Flight Rules and Air law.

1.5. Syllabus

1.5.1. Flight Theory

- 1.5.1.1. Flying controls; direction of movement; effect and purpose of use of spoilers, if fitted and their effects on launching;
 1.5.1.2. Factors to be taken into account when loading a Glider prior to flight;
 1.5.1.3. Precautions to be observed when recovering from the more unusual

attitudes of flight i.e., steep turns, steep dives etc.,

- 1.5.1.4. General rules to be followed at a launching point with regard to safe handling of Gliders.

1.5.2. Glider Operating Limitations

- 1.5.2.1. Airframe limitations; permitted maneuvers, speed limitations;
- 1.5.2.2. Knowledge of various methods used for Glider towing with their respective advantages and disadvantages;
- 1.5.2.3. General precautions to be followed in the event of cable breakage, tow failure etc;
- 1.5.2.4. General knowledge of daily inspection on Gliders;
- 1.5.2.5. Certificate of Airworthiness; information contained therein;

1.5.3. Knowledge Of Instruments And Compass

- 1.5.3.1. Instruments and their principle of working with the pilot, serviceability check prior to flight error and limitations.

1.5.4. Meteorology

- 1.5.4.1. Weather phenomena connected with soaring due to thermals, clouds, hill slopes etc.
- 1.5.4.2. Effect of temperature, density and winds on launching a sailplane.

1.5.5. Aviation Law

- 1.5.5.1. Rules and Regulations relevant to the holder of a glider pilot Licence; Rules of the air; appropriate ATS practices and procedures;
- 1.5.5.2. Dangerous flying; flying over Cities; rules concerning aerobatics; Smoking near aircraft; parachute descents and dropping of articles, renewal; validity of Glider Pilot's Licence etc.

1.5.6. Accidents

- 1.5.6.1. Notifiable accident; Accident of serious structural damage.
- 1.5.6.2. Distress Urgency and Safety Signals; Signals displayed in the Signals Area on an airfield.

1.5.7. General rules for air traffic

- 1.5.7.1. Risk of collision; Risk of collision in Air traffic routes; Aircraft having the right of way; weather minima for I.F.R. conditions.

1.6. Recommended Study Material

- 1.6.1. Glider Pilots Manual
- 1.6.2. From the ground up :Canadian
- 1.6.3. Private Pilots Manual (Jepp & Sanderson)
- 1.6.4. CAR's 94, AIP, NOTAMS.

2. **TECHNICAL EXAMINATION FOR GLIDER INSTRUCTOR'S RATING**

2.1. **GPL-2**

- 2.1.1. Questions : 50
 2.1.2. Pass percentage : 70%
 2.1.3. Time allowed : 01 hour 30 minutes
 2.1.4. Validity : 12 months

2.2. **Question Setting**

- 2.2.1. Flight Theory : 20%
 2.2.2. Glider Instructions : 40%
 2.2.3. Glider Operations : 20
 2.2.4. Meteorology : 10%
 2.2.5. Compass and Instruments : 10%

2.3. **Syllabus**

2.3.1. **Flight Theory**

- 2.3.1.1. Ability to impart instructions on forces acting on a glider in flight gliding for range and endurance, effect of weight, temperature and density on gliding;
 2.3.1.2. Explanation of stalling, spinning, autorotation;

2.3.2. **Glider Instructions**

- 2.3.2.1. Airframe limitations, permitted manouvres, speed limitations operating speeds;
 2.3.2.2. Knowledge of various methods used for glider towing with their respective advantages and disadvantages;
 2.3.2.3. General precautions to be followed in the event of cable breakage, tow failure etc;
 2.3.2.4. General knowledge of daily inspection on gliders;
 2.3.2.5. Certificate of Airworthiness, information contained therein;

2.3.3. **Gliding Operations**

- 2.3.3.1. Sequences of instruction for gliding;
 2.3.3.2. Qualifications for the International Gliding Certificate;
 2.3.3.3. Issue and renewal of Glider Pilot Licence;

2.3.4. **Meteorology**

- 2.3.4.1. Factors effecting development of thermals;
 2.3.4.2. Weather phenomena connected with soaring due to thermals,

clouds, hill slopes;

2.3.4.3. Effect of temperature on launching of gliders;

2.3.4.4. Cloud types and categories with names of clouds that are advantageous to soaring;

2.3.4.5. Various types of cloud formation;

2.3.4.6. General knowledge of the phenomena connected with fog mist, and other hazards to gliding;

2.3.5. **Compass And Instruments**

2.3.5.1. Instruments and their principle of working with the pilot serviceability check prior to flight.

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates /training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner

FLIGHT ENGINEER LICENCE

1. FLIGHT ENGINEER'S TECHNICAL EXAMINATION

1.1. Type of Papers

- 1.1.1. Flight Engineer's Licence Examination : FE
1.1.2. Flight Engineer's Re-validation Licence Examination : FE-R

1.2. FE

- 1.2.1. Questions : 100
1.2.2. Pass percentage : 70%
1.2.3. Time allowed : 03:00 hours
1.2.4. Validity : 24 months

1.3. FE-R For renewal of Flight Engineer's Licence a candidate shall pass written examination of paper FE-R. A paper shall have :-

- 1.3.1. Questions : 50
1.3.2. Pass percentage : 70%
1.3.3. Time allowed : 01 hour 30 minutes
1.3.4. Validity : 24 months
1.3.5. Question Setting : Flight Rules and Air law

1.4. Syllabus The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a flight engineer licence, in at least the following subjects:

1.4.1. Air Law

- 1.4.1.1. Rules and regulations relevant to the holder of Flight Engineer Licence; rules and regulations governing the operation of civil aircraft pertinent to the duties of a flight engineer in Pakistan.

1.4.2. Aircraft General Knowledge

- 1.4.2.1. Basic principles of powerplants, gas turbines and piston engines; characteristics of fuels, fuel systems including fuel control; lubrication systems; afterburners and injection systems, function and operation of engine ignition and starter systems;
1.4.2.2. Principles of operation, handling, procedures and operating limitations of aircraft powerplants; effects of atmospheric conditions on engine performance;
1.4.2.3. Airframes, flight controls, structures, wheel assemblies, brakes and anti-skid units, corrosion and fatigue life; identification of structural damage and defects;
1.4.2.4. Ice and rain protection systems;

- 1.4.2.5. Pressurization and air-conditioning systems, oxygen system
- 1.4.2.6. Hydraulic and pneumatic systems;
- 1.4.2.7. Basic electrical theory, electric systems (AC and DC), aircraft wiring systems, bonding and screening;
- 1.4.2.8. Principles of operation of instruments, compasses, auto-pilots, radio communication equipment, radio and radar navigation aids, flight management systems, displays and avionics;
- 1.4.2.9. Limitations of appropriate aircraft;
- 1.4.2.10. Fire protection, detection, suppression and extinguishing systems;
- 1.4.2.11. Use and serviceability checks of equipment and systems of appropriate aircraft;
- 1.4.3. **Flight Performance and Planning**
 - 1.4.3.1. Effects of loading and mass distribution on aircraft handling, flight characteristics and performance; mass and balance calculations,
 - 1.4.3.2. Use and practical application of performance data including procedures for cruise control;
- 1.4.4. **Human Performance and limitation**
 - 1.4.4.1. Human performance and limitations, relevant to the flight engineer including principles of threat and error management;
- 1.4.5. **Operational Procedure**
 - 1.4.5.1. Principles of maintenance, procedures for the maintenance of airworthiness, defect reporting, pre-flight inspections, precautionary procedures for fuelling and use of external power; installed equipment and cabin systems.
 - 1.4.5.2. Normal, abnormal and emergency procedures;
 - 1.4.5.3. Operational procedures for carriage of freight and dangerous goods;
- 1.4.6. **Principles of Flight**
 - 1.4.6.1. Fundamentals of aerodynamics
- 1.4.7. **Fundamentals of Navigation**
 - 1.4.7.1. Principles and operation of self-contained systems; and
- 1.4.8. **Operational aspects of Meteorology**
 - 1.4.8.1. Interpretation and application of aeronautical meteorological reports, charts and forecasts; use of, and procedures for obtaining, meteorological information, pre-flight and in flight; altimetry;
 - 1.4.8.2. Aeronautical meteorology; climatology of relevant areas in respect of the elements having an effect upon aviation; the movement of pressure systems, the structure of fronts, and the origin and characteristics of significant weather phenomena which affect take-off, en-route and landing conditions; hazardous weather avoidance;

1.4.9. **Radiotelephony**

1.4.9.1. Radiotelephony procedures and phraseology

1.5. **Recommended Study Material**

1.5.1. Study Material, Mechanics of Flight, A.C. Kermode.

1.5.2. Aircraft Systems & Integrated systems, EHJ Pallett

1.5.3. Ground Studies for Pilots, R.B. Underdown :Vol 1,2,3,4

1.5.4. Aircraft Systems for Pilots, D.D. Remer

1.5.5. Human factors for Aviation, Basic / Advance handbook, Air Transport Canada

1.5.6. FAA FE Questionnaires, :Gleim / ASA

1.5.7. Jepessen Airway Manual

1.5.8. CAR's 94, AIP, ANOs, Airworthiness Notices

1.5.9. Pilots Weight and Balance Handbook

1.5.10. AC 65-9 Air Frame and Power Plant Mechanics General Handbook

1.5.11. AC 65-12 Air Frame a Power Plant Mechanics Power Plant Handbook

1.5.12. AC 65-15 Air Frame and Power Plant

1.5.13. Mechanics Air Frame Handbook

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates / training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner.

FLIGHT OPERATIONS OFFICERS LICENCE

1. **FOO TECHNICAL EXAMINATION**

1.1. **Type of Papers**

1. Aircraft General Knowledge and Principles of Flight
2. Air Law, ATC Procedures and operational procedures
3. Meteorology and Flight Planning
4. Performance, Human Performance and Behavior.
5. Mass and Balance and General Navigation
6. Radio navigation and Instrumentation
7. Instrument Procedures
8. VFR and IFR Communication

Aviation Law Examinations for revalidation: FOO-R

1.2. **FOO**

- | | | |
|------------------------|---|-------------|
| 1.2.1. Questions | : | 100 |
| 1.2.2. Pass percentage | : | 70% |
| 1.2.3. Time allowed | : | 03:00 hours |
| 1.2.4. Validity | : | 24 months |

1.3. **FOO-R**

- | | | |
|-------------------------|---|-------------------------------|
| 1.3.1. Questions | : | 50 |
| 1.3.2. Pass percentage | : | 70% |
| 1.3.3. Time allowed | : | 01 hour 30 minutes |
| 1.3.4. Validity | : | 24 months |
| 1.3.5. Question Setting | : | Flight Rules and Aviation Law |

TECHNICAL EXAMINATION SYLLABUS

1. **FLIGHT RULES & LAW**

- 1.1. Definition of terms:
- 1.2. Application of rules, compliance with rules, authority & privileges of pilot-in-command.
- 1.3. **General rules**

- 1.3.1 Reckless or Negligent Operation of Aircraft Fitness of Flight Crew Members
- 1.3.2 Alcohol or Drugs - Crew Members
- 1.3.3 Alcohol or Drugs- Passengers
- 1.3.4 Smoking
- 1.3.5 Aircraft Operating Limitations
- 1.3.6 Portable Electronic Devices
- 1.3.7 Fueling with Engines Running
- 1.3.8 Starting and Ground Running of Aircraft Engines
- 1.3.9 Aircraft Icing
- 1.3.10 Minimum Altitudes and Distances
- 1.3.11 Permissible Low Altitude Flight
- 1.3.12 Right-of-way - General
- 1.3.13 Right-of-way - Aircraft manoeuvring on Water
- 1.3.14 Avoidance of Collision
- 1.3.15 Entering or Leaving an Aircraft in Flight
- 1.3.16 Fuel Dumping
- 1.3.17 Compliance with Air Traffic Control Instructions and Clearances
- 1.3.18 Airspeed Limitations
- 1.3.19 Supersonic Flight
- 1.3.20 Cruising Altitudes and Cruising Flight Levels
- 1.3.21 Altimeter Setting and Operating Procedures in the Altimeter-Setting Region
- 1.3.22 Altimeter Setting and Operating Procedures in the Standard Pressure Region
- 1.3.23 Altimeter Setting and Operating Procedures in Transition Between Regions.
- 1.3.24 Landing at or Take-off from an Aerodrome at Night
- 1.3.25 Visual Flight rules
- 1.3.26 Instrument Flight rules
- 1.4. **Personnel licensing**
 - 1.4.1 Definition of terms used, general rules concerning licenses.

1.4.2 The flight operations officer's licence; privileges and limitations, validity and renewal.

1.5. **Airworthiness regulations of aircraft**

1.5.1 Certificate of airworthiness; normal validity, temporary loss of airworthiness, procedure for revalidating certificate or airworthiness.

1.6. **Facilitation**

1.6.1 Definition of terms, scheduled and non-scheduled operations, traffic freedoms.

1.6.2 Entry and departure of aircraft, description and use of aircraft documents, outbound procedures, consecutive stops at two or more international airports, in one state, completion of aircraft documents, arrangements concerning non-schedule international services.

1.6.3 Entry and departure of persons, entry requirements and procedures, departure requirements and procedure, completion of passengers and crew documents, custody and care of passengers and crew.

1.6.4 Entry and departure of cargo, documentary requirements, procedure for the clearance of cargo, mail, documents and procedures.

1.6.5 Traffic passing through a state, traffic arriving and departing on the same flight, traffic being transferred to another flight on the same airport, traffic being transferred to another airport, free airports and free zones.

1.6.6 Procedure on landing at places other than international airports.

1.6.7 Documents, procedures and facilities for sanitation, medical services, and agricultural quarantine.

1.7. **Air traffic services**

1.7.1 Definition of terms

1.7.2 Objectives of air traffic services, division of ATS, designation of airspace controlled by ATS, designation of units providing ATS, flight information regions, control areas and control zone, advisory areas, advisory routes coordination between operators and ATS.

1.7.3 Air traffic services, notification of rescue coordination centre, plotting aircraft in state of emergency, information to those concerned.

1.7.4 Alerting service, notification of rescue coordination centre, plotting aircraft in state of emergency, information to those concerned.

1.7.5 Physiological aspect of high altitudes flights, basic knowledge of the importance of oxygen, pressurization, hypoxia, hyperventilation, vertigo, cramps etc.

1.7.5.1. Effects on vision, night and day

1.7.5.2. Regulations on the use of oxygen in the aircraft

- 1.7.6 Scope of flight information service.
- 1.7.7 Air traffic service requirements for communications, aeronautical mobile services, aeronautical fixed services.
- 1.7.8 Air traffic service requirements for meteorological information flight information centre, units providing approach, approach control service, aerodrome control towers.
- 1.8. **Aeronautical information service**
 - 1.8.1 Definition of terms used.
 - 1.8.2 Responsibility and function, exchange of aeronautical information.
 - 1.8.3 Contents and specification of aeronautical information publications (AIP) Pakistan.
 - 1.8.4 NOTAM: Origination, distribution, general specifications for class I and class II distribution, 5 letter codes of aeronautical information circulars (AIC).
 - 1.8.5 Origination, specification and distribution of aeronautical information
 - 1.8.6 RAG: origination, distribution general specifications.
 - 1.8.7 Pilots' responsibilities in respect of preflight and post-flight information.
- 1.9. **Search and Rescue**
 - 1.9.1 Definition of the terms INCERFA, ALERFA, DISTRESSFA.
 - 1.9.2 Outline off organization and operation of search and rescue, pilot's responsibilities and actions in the operation of search and rescue, signals used in search operations.
- 1.10. **Regulations**
 - 1.10.1 Knowledge and practical usage of;
 - 1.10.1.1. Aeronautical Information Publication of Pakistan (AIP).
 - 1.10.1.2. Civil Aviation Rules, 1994 (CAR 94).
 - 1.10.1.3. Manual of Air Traffic Services.
 - 1.10.1.4. Jeppessen Manual
 - 1.10.1.5. ICAO Annexes (1-18).
- 2. **FLIGHT NAVIGATION**
 - 2.1. **Form of the earth**
 - 2.1.1 Position, direction and distance on earth's surface, great circle,

- 2.1.2 Rhumb line, nautical mile, statute mile, kilometer.
- 2.2. **Computer slide rule**
 - 2.2.1 Speed and distance problems, fuel problems;
 - 2.2.2 Conversion of Units;
- 2.3. **Maps and charts**
 - 2.3.1 Summary of projections, properties, scale representation, charts for navigational use.
 - 2.3.2 Mercator chart, construction, features, uses, measurement of tracks, bearing and distances, scale presentation;
 - 2.3.3 Lambert conformal, construction, features, uses measurement of tracks, bearings and distances, scale presentation.
 - 2.3.4 Polar Stereographic, construction, properties, uses;
 - 2.3.5 World aeronautical charts, projections, symbols, source of supply, scale, sheet numbering.
 - 2.3.6 Summary of ICAO recommended charts and their uses; aerodrome obstruction, plotting, radio navigation, terminal area, instrument approach, visual approach, aerodrome and aeronautical navigation charts.
 - 2.3.7 Graticule Outline and use of grid reference systems.
- 2.4. **Introduction to plotting**
 - 2.4.1 Plotting and determining positions, on Mercator and Lambert Conformal charts.
 - 2.4.2 Measuring, bearing and distance on mercator and lambert's conformal charts.
- 2.5. **Basic information derived from instruments**
 - 2.5.1 Magnetic compass, earth's magnetic field, heading, variation, deviation application of variation and deviation, compass errors in flight.
 - 2.5.2 Air temperature.
 - 2.5.3 Altimeter, altimeter terms, errors in altimeters, computing, pressure subscale, effect of pressure changes on readings, use of standards pressure flight travels, transition altitude.
- 2.6. **Effect of wind on aircraft**
 - 2.6.1 Introduction to vectors, triangle of velocities, terms associated with triangle of velocities.
 - 2.6.2 Plotting of triangle, solution of problems by plotting and estimation.
- 2.7. **Vector problems**

- 2.7.1 Introduction to computers, working examples, comparison of accuracy obtained by estimation, plotting and computer.
- 2.7.2 Wind finding by computer and by plotting.
- 2.8. **Elements of dead reckoning**
 - 2.8.1 Introduction, importance of common sense and reasoning.
 - 2.8.2 Basic problems, determination of positions, heading and ETA.
 - 2.8.3 Lines of position, types of position lines.
 - 2.8.4 Fixing position with two or more simultaneous position lines, plotting, cocked hat, selection of position.
- 2.9. **Map reading**
 - 2.9.1 Interpreting chart symbols, folding and marking charts from flight planning point of view.
 - 2.9.2 Comparative value of check points, importance of cross checking pinpoints.
 - 2.9.3 Estimation of distances, orientation of map with aircraft heading reliable and unreliable features.
- 2.10. **Time**
 - 2.10.1 Universal Time Coordinated, local meantime, zone time, standard time, conversion of time, relation between longitude and time.
 - 2.10.2 International dateline, leap year.
- 2.11. **Sunrise, sunset, twilight, calculation from air almanac**
- 2.12. **Dead reckoning navigation**
 - 2.12.1 Plotting exercises
 - 2.12.1.1. Plotting triangle of velocity on chart, selection of scale, introduction to plotting symbols.
 - 2.12.1.2. Plotting simple flight from departure to destination, determining track, ground speed and ETA.
 - 2.12.2 Fixing position
 - 2.12.2.1. Method of defining position, latitude and longitude, bearing and distance, plotting giving position by both methods, plotting symbols for positions.
 - 2.12.3 Use of the fix
 - 2.12.4 Air plot

- 2.12.4.1. Plotting positions on the basis of data given by aircraft in flight, use of reporting points.
- 2.12.5 Position lines
 - 2.12.5.1. Transferring position lines selection of line to be transferred procedure of transferring forward or backward.
 - 2.12.5.2. Use of single position lines as track or ground speed check.
- 2.12.6 Problems of finding average air speed, methods used to determine TAS on climb.
 - 2.12.6.1. Problems of wind velocity, methods used to determine wind velocity during climb.
- 2.12.7 Practical navigation
 - 2.12.7.1. Critical point, definition of term, factors to be taken into calculation.
 - 2.12.7.2. Critical point, expression critical point in terms of time, distance and position. Point of no Return (PNR) & Equi-time point (ETP)
 - 2.12.7.3. Critical point, expressing critical point and PNR in terms of time, distance and position
 - 2.12.7.4. Radius of action returning to the same base, point of no return, solution by plotting and computer, allowance for fuel reserves.
 - 2.12.7.5. Solution of critical point. PNR and square search problems.
- 2.13. **Flight plan and navigation logs**
 - 2.13.1 Importance of documents, emphasis on importance and accuracy of information.
 - 2.13.2 Outline of information contained in flight plans and navigation logs, standard international flight plan, company flight plan. Filling ATC flight Plan.
- 2.14. **Navigation exercises**
 - 2.14.1 Pilot navigation problems.
 - 2.14.2 Plotting exercises compiled to simulate real flight conditions for practicing the application of principles already taught. Navigation logs and simple flight plan to be used with all plots.
- 2.15. **Pilot navigator**
 - 2.15.1 Pilot's navigation problems, practical applications.
 - 2.15.2 Flight planning and preparation, map preparation, drift lines, bearings, distance.
 - 2.15.3 Mental dead reckoning, one-in-sixty rule, use of drift lines alteration off heading to parallel track, closing in on track, estimation of wind effect,

distance direction and flight time.

2.16. **Navigation problems**

2.16.1 Methods of conducting simple searches including the square search;

2.17. Exercise in reading jeppesen flight planning charts. Measuring tracks and distances on Jeppesen charts.

3. **FLIGHT PLANNING**

3.1. **The flight plan**

3.1.1 The purpose, use, value and limitations of the flight plan.

3.1.2 The air traffic control flight plan.

3.1.3 Information required in the air traffic control flight plan.

3.1.4 Division into zones.

3.1.5 Division of a long flight into appropriate zones.

3.1.6 Preparation of flight plan into ETA's fuel requirements (including reserves), and zone gross weights for prop-turbo-prop, and jets.

3.2. **Application of the flight plan:** Determination of the following from the data available in the flight plan

3.2.1 Critical point.

3.2.2 Point of no return.

3.2.3 Maximum payload available.

3.2.4 Safety heights.

3.2.5 Wind component for take-off/landing.

3.2.6 Effect of failure of one or more power units on the critical point and on PNR.

3.3. Aircraft performance and flight planning

3.3.1 Methods of presenting aircraft performance data such as those relating to power, speed, altitude etc. Curves and tabulated values, their use.

3.3.2 Methods of cruise control, constant power, constant speed, long range, maximum endurance, scheduled ground speed.

3.3.3 Flight at high speed and high altitude.

3.4. **The choice of route and amount of reserve fuel**

3.4.1 The selection of best route and altitude considering weather, minimum time / fuel path, engine and aircraft performance, payload, air traffic regulations, availability

of navigation aids and emergency enroute alternates.

- 3.4.2 The selection of alternates considering weather, available facilities economy and aircraft capability;
- 3.4.3 The preparation of flight plan by the various cruise control procedures giving headings, ETA's fuel requirements (including reserves);

3.5. **The use of aircraft performance data**

A knowledge of aerodynamics and engine characteristics sufficient to understand the variation of aircraft performance with height and weight, and the relation between the power, speed and fuel consumption is desired.

- 3.5.1 Determination of maximum permissible aircraft weight for take-off under various conditions of temperature, pressure and humidity from graphs and tables. Calculations of C.G. and adjustment of load for safe C.G. limit operation, trim sheet preparation. Determination of pay load.
- 3.5.2 The limitations imposed on payload by the effect of runway length and gradient; wind component at take-off. Maximum landing weight and zero fuel weight. Preparation of manifest.
- 3.5.3 The use of aircraft performance data and meteorological data for the determination of optimum conditions for climbing, cruising and descent;
- 3.5.4 The use of aircraft performance data and meteorological data for the determination of point of no return, still air range, point of equal time. Effect of the failure of one or more power units on the point of no return and point of equal time;
- 3.5.5 Flight progress charts. BOW, ZFW, MTOGW, B/OFF, MLW etc. and there relation to one another;
- 3.5.6 Modification of the flight plan necessitated by conditions experienced in flight e.g., the selection of alternate routes and aerodromes in the event of failure of one or more power units.

4. **RADIO AIDS TO NAVIGATION**

4.1. **Principles of radio transmission and reception**

- 4.1.1 Direct current and alternating current.
- 4.1.2 Properties of radio waves:
 - 4.1.2.1. Propagation characteristics (in so far as they concern navigation) of the frequencies of the radio spectrum, viz; range of the ground wave at different frequencies, susceptibility to coastal refraction and static at different frequencies. Sky wave at different frequencies, their reliability, maximum and minimum range, diurnal variation.

4.2. **Radio aids to navigation**

- 4.2.1 Direct finding

- 4.2.1.1. The elements of direction finding.
- 4.2.1.2. Characteristics of MFDF, HFDF, HDF
- 4.2.1.3. Resolving the 180 ambiguity.
- 4.2.1.4. Direction finding errors; night effect, coastal effect, quadrantal error.
- 4.2.2 Automatic Direction Finder (A.D.F.)
 - 4.2.2.1. Principles, comparison with manual loop.
 - 4.2.2.2. Position lines and fixes.
 - 4.2.2.3. Homing Orientation.
 - 4.2.2.4. Range and accuracy.
- 4.2.3 Ground D/F systems
 - 4.2.3.1. Outline and basic principles of MFDF, HFDF, VHFDF
 - 4.2.3.2. Use of bearings and fixes.
- 4.2.4 Very high frequency omni range (VOR).
 - 4.2.4.1. General principles.
 - 4.2.4.2. Range and accuracy.
 - 4.2.4.3. Use.
 - 4.2.4.4. Airways procedures.
- 4.2.5 Distance measuring equipment (DME)
 - 4.2.5.1. General principles.
 - 4.2.5.2. Range and accuracy.
 - 4.2.5.3. Use.
- 4.2.6 Instrument landing system (ILS)
 - 4.2.6.1. The determination of bearing and glide path by lobe comparison. Ground and airborne equipment.
- 4.2.7 Radio altimeter.
 - 4.2.7.1. Frequency modulation.
 - 4.2.7.2. Measurement, general principles, application and limitation.

Note: The student is expected to know operation and uses of the above equipment from the route planning point of view.

4.3. **Elementary radar knowledge**

- 4.3.1 Basic principles of radar detection, range and bearing measurement.
- 4.3.2 Common terms: pulse, pulse width, pulse recurrence frequency PPI, microsecond, delay.
- 4.3.3 Cathode ray tube.
 - 4.3.3.1. Basic principles.
 - 4.3.3.2. Use in navigation instruments.

4.4. **Radar aids to navigation**

- 4.4.1 Ground controlled approach (GCA)
 - 4.4.1.1. A general appreciation of the GCA system and its use as an aid to landing in poor visibility.
- 4.4.2 Cloud and collision warning equipment.
 - 4.4.2.1. Principles and general application.
- 4.4.3 **Radar altimeter**
 - 4.4.3.1. Height measurement by pulse technique
 - 4.4.3.2. Principle of operation
 - 4.4.3.3. Practical use-
 - 4.4.3.4. Errors and limitations.

4.4.4 **Transponder systems**

- 4.4.4.1. Basic principles of the transponder type radar aids.

4.4.5 **Warning & recording system**

- 4.4.5.1. Elementary knowledge & basic concepts of working and operation of
 - 4.4.5.1.1. GPWS
 - 4.4.5.1.2. TCAS
 - 4.4.5.1.3. Flight Data Recording Systems.
 - 4.4.5.1.4. Cockpit Voice recording System.

4.5. **Inertial and Doppler navigation systems**

4.5.1 Basic knowledge of principles only.

5. **METEOROLOGY**

5.1. **Physical basis of meteorology**

5.1.1 Description of the composition and extent of the atmosphere.

5.1.2 Atmospheric pressure and atmospheric density.

5.1.2.1. Definition of pressure, temperature, density and absolute temperature. Their relationship.

5.1.2.2. Variation of pressure with height, (in general terms only).

5.1.2.3. Reduction of pressure to mean sea level.

5.1.2.4. Representation of surface pressure by isobars.

5.1.3 Heat and temperature.

5.1.3.1. The process of heat balance and heat transfer.

5.1.3.2. Temperature distribution.

5.1.4 Humidity and water vapour.

5.1.4.1. Water vapour in the atmosphere.

5.1.4.2. Vapour pressure, effect on density.

5.1.4.3. Absolute, relative and specific humidity.

5.1.4.4. Condensation, precipitation and sublimation.

5.1.5 Stability in the atmosphere.

5.1.5.1. Adiabatic process.

5.1.5.2. Lapse rates.

5.1.5.3. Atmospheric equilibrium.

5.1.5.4. Stability of dry air and saturated air conditional instability.

5.1.5.5. Convection.

5.2. **General meteorological phenomenon**

5.2.1 Wind near the surface.

5.2.1.1. Effect of horizontal pressure gradient on wind force.

5.2.1.2. Relationship between isobaric pattern and wind direction at the surface;

variation with height.

5.2.1.3. Geostrophic and gradient wind, definitions, relationship between the two.

5.2.1.4. Diurnal variation.

5.2.1.5. Local wind effects; and breeze, sea breeze, orographic, anabatic wind, katabatic wind, gusts and squalls.

5.2.2 Turbulence

5.2.2.1. Definition of mechanical, thermal and resultant turbulence, effect on aircraft flying through or close to an inversion; high level turbulence, convergence and divergence.

5.2.3 Clouds

5.2.3.1. International cloud classification. Description, altitude and vertical extent.

5.2.3.2. The physical process of cloud formation and dissipation including orographic cloud, turbulence and advection cloud, convection cloud, contrails.

5.2.3.3. Flying conditions associated with the various types of clouds.

5.2.4 Precipitation

5.2.4.1. Definition; Description of the physical process in the formation of rain; convective, frontal and orographic ice in the air.

5.2.4.2. Effect on aviation of the different types of precipitation.

5.2.5 Ice accretion

5.2.5.1. Types of ice accretion on aircraft.

5.2.5.2. Flight conditions and associated cloud types conducive to ice accretion.

5.2.5.3. Effect of ice accretion on aeroplane, engine and propellers, pilot icing.

5.2.6 Thunderstorms

5.2.6.1. Formation of thunder storms, their structure, conditions conducive to formation, seasonal and diurnal variation.

5.2.6.2. Flight through thunderstorms; effect of lightning and static electricity.

5.2.7 Visibility and Fog

5.2.7.1. Factors affecting visibility; definition, fog, mist and haze.

5.2.7.2. The physical processes of the formation and dissipation of different

types of fog.

5.2.7.3. Conditions favourable to fog formation.

5.2.7.4. Artificial dispersal of fog.

5.3. **Observation and measurement of meteorological elements**

The details given here, in paragraph 5.3 are intended only as a teaching guide. The requirements for FOO licence is only a general idea of what the observer can measure.

5.3.1 Units, methods and equipment used on the ground to measure pressure, temperature, humidity, precipitation, cloud, upper and surface wind, visibility.

5.3.2 Units in use for aeronautical meteorological purposes.

5.3.3 Elements observed by radiosonde and their use.

5.3.4 Elements observed by aircraft on special meteorological duties, their use.

5.3.5 Elements observed by civil aircraft in general, practical ability in making observations.

5.4. **Synoptic meteorology**

5.4.1 Structure of pressure systems, air masses and fronts.

5.4.1.1. Structure of pressure systems. Description and characteristics of the following forms of pressure systems: depression, anticyclone, secondary depression, trough of flow pressure (V - shaped depression) Ridge of high pressure, col. and straight isobars.

5.4.1.2. Air masses: life history, source, path, characteristics and classification, examples.

5.4.1.3. Fronts: definition and classification, the polar front, the intertropical front, principal frontal zones.

5.4.1.4. The polar front theory of depressions, origin and life history of a frontal depression including travel, isallobars.

5.4.1.5. The intertropical front. General description. Associated -weather.

5.4.2 Weather conditions associated with the different types of pressure systems, air masses and associated fronts.

5.4.2.1. Details of distribution of cloud and weather in each of the fundamental types of isobaric system including sequence of weather associated with the passage of such systems.

5.4.2.2. Cloud structure and weather associated with fronts and air masses.

5.4.2.3. Depression families, depressions of non-frontal origin, thermal low, orographic lows, tropical revolving storms, tornadoes, water spouts.

- 5.4.3 Situations giving rise to phenomena of special interest to aviation such as dust and sand storms, turbulent conditions, icing, local wind.
- 5.4.4 Methods of estimating the possible development and movement of pressure systems and associated weather.
 - 5.4.4.1 Deepening and filling of depressions.
 - 5.4.4.2 Effect of mountain ranges on air mass movement and weather.
- 5.4.5 Effect of topographical features on the development of weather with special reference to the effect of mountain ranges on cloud formation.
- 5.4.6 Interpretation of synoptic charts.
 - 5.4.6.1 The interpretation of synoptic charts and of figures and symbols used in preparation of weather charts.
- 5.5. **Altimetry**
 - 5.5.1 Detailed relation between height temperature and pressure. Pressure variation in a vertical column of air.
 - 5.5.2 The standard atmosphere.
 - 5.5.2.1 Definition of pressure altitude and density altitude.
 - 5.5.2.2 Determination of density altitude.
 - 5.5.2.3 Application to the pressure altimeter. Effect of non-standard pressure and temperature.
 - 5.5.2.4 QFE, QFF, QNH, ONE.
 - 5.5.2.5 Calculation of terrain clearance.
- 5.6. **Upper winds**
 - 5.6.1 Geostrophic wind.
 - 5.6.2 Gradient winds, cyclostrophic winds and other geostrophic winds.
 - 5.6.3 The relation between winds at different altitude.
 - 5.6.3.1 The thermal component.
 - 5.6.4 Principles of construction of upper air charts (current and prognostic)
 - 5.6.4.1 Contours of an isobaric surface.
 - 5.6.4.2 Relation between isobaric contours and isobars at a constant height.
 - 5.6.5 Jet streams.
 - 5.6.5.1 Causes, conditions favourable for their existence

- 5.6.5.2. Ability to spot jet streams in upper air charts.
- 5.6.5.3. Clear air turbulence (CAT).
- 5.6.6 Measurement of wind speed and component by contour spacing. The use of templates for the measurement of wind speed and component. The use of scales for cyclostrophic wind effect.
- 5.6.7 Calculation of cross wind component and cross wind effect.
- 5.6.8 Calculation of average wind component.
- 5.7. Practice in reading surface and upper air weather charts so that the FOO could brief aircrew at the counter.
- 5.8. **Climatology**
 - 5.8.1 The general distribution and seasonal variation of pressure, temperature, winds, clouds, precipitation and visibility, and the basic factors affecting their distribution and variation, such as ocean currents, with special reference to the region of the globe to which personnel concerned are assigned.
 - 5.8.2 General and seasonal distribution of meteorological phenomena of special interest to airmen, e.g. dust and sand storms, tropical revolving storms etc. salient features of the climatology of the main world air routes.
 - 5.8.3 A general knowledge of the climatology of the countries in which personnel will serve.
 - 5.8.4 A detailed knowledge of the weather likely to be experienced on the principal air routes.
- 5.9. **Meteorological organization for international air navigation**
 - 5.9.1 **International organization**; use of appropriate manuals for obtaining specifications for meteorological service for international air routes, including meteorological briefing and forms to be used.
 - 5.9.2 Aeronautical meteorological codes e.g. METAR, SPECI, TAF and AIREP, and meteorological portion of the Q codes. (QFE, OFF, ONE, QNH, QTC.)
 - 5.9.3 Sources of meteorological information, including meteorological broadcasts for aviation, in-flight weather reports.
 - 5.9.4 Meteorological documentation.
- 6. **COMMUNICATION PROCEDURES AND REGULATIONS**
 - 6.1. **General**
 - 6.1.1 Glossary of terms and their definitions, used in international aeronautical Tele-communication service (ATS).
 - 6.2. **Administrative Provision and Radio Regulations**

6.2.1 Hours of service, supervision, superfluous transmission. Interference, secrecy of communication. Suspension of service, infringement of procedures.

6.3. **General procedures**

6.3.1 General, extension of service and closing down of station. Acceptance transmission and delivery of messages. Cancellation of messages. Time system, Record of Communication both national and international. Establishment of Radio communication. Use of codes and abbreviations, texts;

6.4. **Aeronautical Fixed Service**

6.4.1 Composition of message. categories of message. order of priority. Class B of paid traffic.

6.5. **Aeronautical Mobile Service**

6.5.1 Composition of message. Categories of message. Order of priority. Language used in R/T procedures. Phonetic alphabets and numbers. Enroute net work communication procedures. Distress, urgency and safety communication.

6.6. **Aeronautical Information Service**

6.6.1 Function of Aeronautical Information Service, briefing and debriefing. dissemination of information. NOTAM Service.

6.6.2 FOO should be able to originate various types of messages and decipher them on receipt.

7. **Recommended Study Material for FOO**

1.3.6. Ground Studies for Pilots - RB Underdown :UK

1.3.7. Meteorology for Pilots - M. Wickson :UK

1.3.8. Aviation Weather Handbook - :FAA

1.3.9. FAA Flight Dispatcher / ATPL Questionnaire.

1.3.10. Jeppessen Airway Manual.

1.3.11. AIP Pakistan

1.3.12. Civil Aviation Rules 1994.

1.3.13. Relevant ICAO Annexes.

Note: 1. CAA does not publish books, but the above mentioned reference books / material is recommended. Candidates /training organizations may select any suitable publication.

Note: 2. The weightage / proportion of questions are just an approximation, which may vary as per the discretion of the Examiner

AIR TRAFFIC CONTROLLER LICENCE

1. Syllabus

1.1. The theory Examination shall be from the following "Approved Syllabus":

- 1.1.1. ICAO Annex 2
- 1.1.2. ICAO Annex 3
- 1.1.3. ICAO Annex 5
- 1.1.4. ICAO Annex 6 Volume-I
- 1.1.5. ICAO Annex 10 Volume-II
- 1.1.6. ICAO Annex 11
- 1.1.7. ICAO Annex 14
- 1.1.8. ICAO Annex 15
- 1.1.9. ICAO Doc 4444: RAC
- 1.1.10. CATI Course Material for Basic Course
- 1.1.11. CATI Course Material for Radar Course
- 1.1.12. Manual of Air Traffic Services
- 1.1.13. Aeronautical Information Publication

1.2. Air Law

- 1.2.1. Rules and regulations relevant to the air traffic controller;

1.3. Air traffic control equipment

- 1.3.1. Principles, use and limitations of equipment used in air traffic control;

1.4. General knowledge

- 1.4.1. Principles of flight; principles of operations and functioning of aircraft, power plants and systems; aircraft performances relevant to air traffic control operations;

1.5. Human performance and limitations

- 1.5.1. Human performance including principles of threat and error management;

1.6. Language

- 1.6.1. The language or languages nationally designated for use in air traffic control and ability to speak such language or languages without accent or impediment, which would adversely affect radio communication;

1.7. Meteorology

- 1.7.1. Aeronautical meteorology; use and appreciation of meteorological

documentation and information; origin and characteristics of weather phenomena affecting flight operations and safety; altimetry;

1.8. Navigation

1.8.1. Principles of air navigation; principle, limitation and accuracy of navigation systems and visual aids; and

1.9. Operational procedures

1.9.1. Air traffic control, communication, radiotelephony and phraseology procedures (routine, non-routine and emergency); use of the relevant aeronautical documentation; safety practices associated with flight.

1.10. AERODROME CONTROL RATING

1.10.1. Aerodrome layout : physical characteristic and visual aids;

1.10.2. Airspace structure;

1.10.3. Applicable rules, procedures and source of information;

1.10.4. Air navigation facilities;

1.10.5. Air traffic control equipment and its use;

1.10.6. Terrain and prominent landmarks;

1.10.7. Characteristics of air traffic;

1.10.8. Weather phenomena ; and

1.10.9. Emergency and search and rescue plans;

1.11. APPROACH CONTROL AND AREA CONTROL RATINGS

1.11.1. Airspace structure;

1.11.2. Applicable rules, procedures and source of information;

1.11.3. Air navigation facilities;

1.11.4. Air traffic control equipment and its use;

1.11.5. Terrain and prominent landmarks;

1.11.6. Characteristics of air traffic and traffic flows;

1.11.7. Weather phenomena ; and

1.11.8. Emergency and search and rescue plans; and

1.12. APPROACH RADAR, APPROACH PRECISION RADAR AND AREA RADAR CONTROL RATINGS

1.12.1. The applicant shall meet the requirements specified in the above paragraph in so far as they affect the area of responsibility, and shall have demonstrated a level of knowledge appropriate to the privileges granted, in at least the following additional subjects:

1.12.1.1. Principles, use and limitations of radar, other surveillance systems

and associated equipment; and

- 1.12.1.2. Procedures for the provision of approach , precision approach or area radar control service, as appropriate, including procedures to ensure appropriate terrain clearance

2. ATCO TECHNICAL EXAMINATION

2.1. Type of Papers

2.1.1. ATC Licence	:	ATC-1
2.1.2. ATC Licence	:	ATC-2
2.1.3. ATCR (Aerodrome)	:	ATCR-1
2.1.4. ATCR (Approach)	:	ATCR-2
2.1.5. ATCR (Approach radar)	:	ATCR-3
2.1.6. ATCR (Approach Precision)	:	ATCR-4
2.1.7. ATCR (Area)	:	ATCR-5
2.1.8. ATCR (Area Radar)	:	ATCR-6

2.2. ATC-1

2.2.1. Questions	:	100
2.2.2. Pass percentage	:	70%
2.2.3. Time allowed	:	03:00 hours
2.2.4. Validity	:	24 months
2.2.5. Question Setting	:	General Aviation Knowledge as per Annex-1
2.2.6. Recommended study material	:	ICAO Annexes 3, 5, 10, 14 and 15

2.3. ATC-2

2.3.1. Questions	:	100
2.3.2. Pass percentage	:	70%
2.3.3. Time allowed	:	03:00 hours
2.3.4. Validity	:	24 months
2.3.5. Question Setting	:	Practical aspects of ATC
2.3.6. Recommended study material	:	ICAO Annexes 2, 6, 11 & Doc 44444

2.4. ATCR-1

2.4.1. Questions	:	100
2.4.2. Pass percentage	:	70%
2.4.3. Time allowed	:	03:00 hours

- 2.4.4. Validity : 24 months
- 2.4.5. Question Setting : Practical aspects of Aerodrome Control Rating
- 2.4.6. Recommended study material : Doc 4444 & CATI Study material
- 2.5. **ATCR-2**
- 2.5.1. Questions : 100
- 2.5.2. Pass percentage : 70%
- 2.5.3. Time allowed : 03:00 hours
- 2.5.4. Validity : 24 months
- 2.5.5. Question Setting : Practical aspects of Approach Control Rating
- 2.5.6. Recommended study material : Doc 4444
- 2.6. **ATCR-3**
- 2.6.1. Questions : 100
- 2.6.2. Pass percentage : 70%
- 2.6.3. Time allowed : 03:00 hours
- 2.6.4. Validity : 24 months
- 2.6.5. Question Setting : Practical aspects of Approach Radar Control Rating
- 2.6.6. Recommended study material : Doc 4444
- 2.7. **ATCR-4**
- 2.7.1. Questions : 100
- 2.7.2. Pass percentage : 70%
- 2.7.3. Time allowed : 03:00 hours
- 2.7.4. Validity : 24 months
- 2.7.5. Question Setting : Practical aspects of Approach Precision Radar Control Rating
- 2.7.6. Recommended study material : Doc 4444
- 2.8. **ATCR-5**
- 2.8.1. Questions : 100
- 2.8.2. Pass percentage : 70%
- 2.8.3. Time allowed : 03:00 hours
- 2.8.4. Validity : 24 months

- 2.8.5. Question Setting : Practical aspects of Area Control Rating
- 2.8.6. Recommended study material : Doc 4444
- 2.9. **ATCR-6**
- 2.9.1. Questions : 100
- 2.9.2. Pass percentage : 70%
- 2.9.3. Time allowed : 03:00 hours
- 2.9.4. Validity : 24 months
- 2.9.5. Question Setting : Practical aspects of Area Radar Control Rating
- 2.9.6. Recommended study material : Doc 4444
- 2.10. **THEORY EXAMINATIONS**
- 2.10.1. The theory examination shall be from the following "Approved Syllabus":
- 2.10.1.1. ICAO Annex 2
 - 2.10.1.2. ICAO Annex 3
 - 2.10.1.3. ICAO Annex 5
 - 2.10.1.4. ICAO Annex 6 Volume-I
 - 2.10.1.5. ICAO Annex 10 Volume-II
 - 2.10.1.6. ICAO Annex 11
 - 2.10.1.7. ICAO Annex 14
 - 2.10.1.8. ICAO Annex 15
 - 2.10.1.9. ICAO Doc 4444 :RAC
 - 2.10.1.10. CATI Course Material for Radar Course
 - 2.10.1.11. Manual of Air Traffic Services
 - 2.10.1.12. Aeronautical Information Publication
- 2.11. An applicant is required to qualify papers ATC-1, ATC-2 and at least one ATC Rating paper (ATCR) to qualify for an ATC Licence.

FLIGHT RADIO TELEPHONY OPERATOR LICENCE

1. **FLIGHT RADIO TELEPHONY OPERATOR EXAMINATION**

1.1. **Type of Papers**

- 1.1.1. FRTOL Examination : FRTOL-1
1.1.2. FRTOL Practical Test (ORAL): FRTOL-2

1.2. Paper FRTOL-1 for the issue of FRTOL Licence a candidate shall pass written examination of paper FRTOL-1. A paper shall have

- 1.2.1. Questions : 50
1.2.2. Pass percentage : 70%
1.2.3. Time allowed : 01 hour 30 minutes
1.2.4. Validity : 12 months

1.3. **Syllabus**

- 1.3.1. Exchange of communication between aircraft station and a ground station
1.3.2. Application on radiotelephony procedures
1.3.3. Application of phonetic letters
1.3.4. Clarity and precision of communication
1.3.5. Normal-type messages encountered in R/T communications
1.3.6. Departure and arrival procedures
1.3.7. Request for D.F
1.3.8. Passing of position reports
1.3.9. Request for MET information
1.3.10. Distress procedures
1.3.11. Urgency procedures
1.3.12. Safety procedures
1.3.13. Theory of radio wave-propagation
1.3.14. H.F. Radio telephony
1.3.15. V.H.F. radio telephony
1.3.16. Current radiotelephony operation procedures and practices
1.3.17. Composition of messages
1.3.18. Order of priority
1.3.19. Categories of messages

- 1.3.20. Special codes, abbreviations and signals
- 1.3.21. Distress procedures
- 1.3.22. Urgency procedures
- 1.3.23. Safety procedures
- 1.3.24. Current frequencies and their use
- 1.3.25. Publications and notices
- 1.3.26. Detailed knowledge of these CAA / ICAO Publications and NOTAMs
- 1.3.27. Ability to refer those, with speed and then apply the information contained therein, to individual cases.

AIRCRAFT MAINTENANCE ENGINEER LICENCE

1. Syllabus

1.1. Air Law and Airworthiness Requirements

Rules and regulations relevant to aircraft maintenance engineer Licence holder including applicable airworthiness requirements governing certification and continuing airworthiness of aircraft and approved aircraft maintenance organizations and procedures

1.2. Natural Science and Aircraft General Knowledge

Basic Mathematics, Units of Measurements, Theory of Flight, High speed theory of flight, Fundamental principles and theory of physics and chemistry applicable to aircraft maintenance & equivalent to HSSC level.

1.3. Aircraft Engineering

Characteristics and application of the materials of aircraft construction including principles of construction and functioning of aircraft structures, fastening techniques, power plants and their associated systems, mechanical, fluid. Electrical and electronic power sources, aircraft instrument and display system, Digital electronics & logic circuits, aircraft control systems and airborne navigation and communication systems.

1.4. Aircraft Maintenance

Tasks required to ensure the continuing airworthiness of an aircraft including methods and procedures for the repair, Inspection, replacement, modification or defect rectification of aircraft structure, components and systems as per applicable standards of airworthiness.

2. Aircraft Maintenance Engineer Licence

2.1. Type of Papers

2.1.1. Airframe Basic Examination	: AME-1
2.1.2. Engines Basic Examination	: AME-2
2.1.3. Electrical Basic Examination	: AME-3
2.1.4. Instrument Basic Examination	: AME-4
2.1.5. Communication and navigation basic examination	: AME-5
2.1.6. Radar Basic Examination	: AME-6

2.2. Airframe Basic Examination (paper AME-1)

2.2.1. Questions	: 100
2.2.2. Pass percentage	: 70%
2.2.3. Time allowed	: 03:00 hours
2.2.4. Validity	: 24 months

- 2.3. Engines Basic Examinations (paper AME-2)**
- 2.3.1. Questions : 100
- 2.3.2. Pass percentage : 70%
- 2.3.3. Time allowed : 03:00 hours
- 2.3.4. Validity : 24 months
- 2.4. Electrical Basic Examination (paper AME-3)**
- 2.4.1. Questions : 100
- 2.4.2. Pass percentage : 70%
- 2.4.3. Time allowed : 03:00 hours
- 2.4.4. Validity : 24 months
- 2.5. Instrument Basic Examination (AME-4)**
- 2.5.1. Questions : 100
- 2.5.2. Pass percentage : 70%
- 2.5.3. Time allowed : 03:00 hours
- 2.5.4. Validity : 24 months
- 2.6. Communication & Navigation (AME-5)**
- 2.6.1. Questions : 100
- 2.6.2. Pass percentage : 70%
- 2.6.3. Time allowed : 03:00 hours
- 2.6.4. Validity : 24 months
- 2.7. Radar Basic Examination (AME-6)**
- 2.7.1. Questions : 100
- 2.7.2. Pass percentage : 70%
- 2.7.3. Time allowed : 03:00 hours
- 2.7.4. Validity : 24 months

COMPETENCY CERTIFICATES CABIN ATTENDANTS

1. CABIN ATTENDANTS COMPETENCY CERTIFICATE EXAMINATION

1.1. Type of Papers

- 1.1.1. Cabin Examination : Cabin-1
- 1.1.2. Cabin Examination : Cabin-2 (Aircraft Specific)
- 1.1.3. Cabin Revalidation Examination : Cabin-R

1.2. Cabin-1

- 1.2.1. Questions : 100
- 1.2.2. Pass percentage : 70%
- 1.2.3. Time allowed : 03:00 hours
- 1.2.4. Validity : 24 months

1.3. Cabin-2

- 1.3.1. Questions : 50
- 1.3.2. Pass percentage : 70%
- 1.3.3. Time allowed : 01hour 30 minutes
- 1.3.4. Validity : 24 months

1.4. Cabin-R

- 1.4.1. Questions : 50
- 1.4.2. Pass percentage : 70%
- 1.4.3. Time allowed : 01 hour 30 minutes
- 1.4.4. Validity : 24 months

1.5. Syllabus

1.5.1. Knowledge

The applicant shall have demonstrated a level of knowledge appropriate to the holder of a Cabin Attendant Competency Certificate, in at least the above mentioned subjects:

1.5.2. Aviation indoctrination

Regulatory aspects

- 1.5.2.1. National and International
- 1.5.2.2. Company - specific

1.5.3. Aviation Terminology and terms of reference

- 1.5.3.1. Terminology
- 1.5.3.2. Terms of reference
- 1.5.4. **Theory of flight & aircraft operations**
 - 1.5.4.1. Theory of flight
 - 1.5.4.2. Major aircraft components
 - 1.5.4.3. Critical surfaces :Contamination of
 - 1.5.4.4. Pressurization system
 - 1.5.4.5. Weight & Balance
 - 1.5.4.6. Meteorology / Turbulence
 - 1.5.4.7. Communications equipment
 - 1.5.4.8. Air Traffic Control
- 1.5.5. **Physiology of flight**
 - 1.5.5.1. Oxygen system and use
 - 1.5.5.2. Effects of altitude
 - 1.5.5.3. Cabin poisoning
- 1.5.6. **Duties And Responsibilities**
 - 1.5.6.1. General responsibilities
 - 1.5.6.2. Pre-flight & Post-flight
 - 1.5.6.3. In-flight
- 1.5.7. **Emergency Procedures**
 - 1.5.7.1. General emergency procedures & basic principles
 - 1.5.7.2. Emergency equipment
 - 1.5.7.3. Fire fighting
 - 1.5.7.4. Smoke removal procedures
 - 1.5.7.5. Emergency lighting systems
 - 1.5.7.6. Decompression- slow / rapid
 - 1.5.7.7. Emergency landing preparations
 - 1.5.7.8. Evacuation procedures
 - 1.5.7.9. Unwarranted evacuations-water ditching
 - 1.5.7.10. Life-and slide-rafts :use of
 - 1.5.7.11. Unlawful interference

1.5.8. **Carriage Of Dangerous Goods**

- 1.5.8.1. General philosophy
- 1.5.8.2. Prohibited and dangerous goods
- 1.5.8.3. Label identification
- 1.5.8.4. Exceptions
- 1.5.8.5. Emergency procedures

1.5.9. **Human Factors**

- 1.5.9.1. Fundamental human factor concepts
- 1.5.9.2. Crew resource management: CRM Recognize and manage threats and errors;

1.5.10. **Hygiene, Aviation Medicine & First Aid**

- 1.5.10.1. Terminology
- 1.5.10.2. Personal hygiene
- 1.5.10.3. Tropical hygiene
- 1.5.10.4. Transmissible diseases
- 1.5.10.5. Quarantinable diseases
- 1.5.10.6. Endemic diseases
- 1.5.10.7. Food poisoning
- 1.5.10.8. In-flight medical emergencies & incidents
- 1.5.10.9. Artificial respiration
- 1.5.10.10. Effects of drugs / intoxicants
- 1.5.10.11. First-aid medical supplies
- 1.5.10.12. First Aid kits: contents & use of
- 1.5.10.13. Medical kits: contents & use of
- 1.5.10.14. Emergency child birth

VALIDATION CERTIFICATES

1. Validation Certificate Examination

- 1.1. Validation Certificates examination, paper VAL-1: For issue of Validation Certificates an applicant shall pass written examination of paper VAL-1. The paper shall have:
 - 1.1.1. Questions : 50
 - 1.1.2. Pass percentage : 70%
 - 1.1.3. Time allowed : 01 hour 30 minutes
 - 1.1.4. Validity : 12 months
- 1.2. The exam shall be of multiple choice type from Flight Rules and Air Law (Annex 2, CARs'94 & Jeppesen)
- 1.3. With prior approval of the DGCAA, validation exam can be conducted at the state of registry of aircraft, at the operator's expense. The team shall consist of 02 members.
- 1.4. The validation exam shall be conducted at the licensing office. Application for any such exam shall be submitted along with the requisite fee voucher (Examination fee plus special exam fee), three days prior to the date requested for the examination. The fee is to be submitted as specified in ANO-021-XXLC-2.0.
- 1.5. Question Setting
 - 1.5.1. Flight Rules and Procedures : 20%
 - 1.5.2. Air Law : 20%
 - 1.5.3. Aeronautical Information Publications : 20%
 - 1.5.4. Jeppesen Airway Manual : 20%
 - 1.5.5. ATC Phraseology in English : 20%
- 1.6. Recommended Study Material
 - 1.6.1. CAR's 94 / ANOs
 - 1.6.2. AIP
 - 1.6.3. ICAO Annex 2 (Rules of the Air) / Jeppesen Airway Manual

APPENDIX "S"

TYPE TECHNICAL EXAMINATION (TT-1)

1. Type Technical paper (TT-1) in case of flight crew for Aircraft weight category below 5700kgs, will be conducted by the Licensing office or aviation training organization. For aircraft weight categories more than 5700Kgs, the approved training program / type conversion ground-training course shall contain the type technical, conducted by the approved aviation training organization.
2. Type Technical Exam paper TT-1: The type technical examination shall consist of two parts, part 'A' for aircraft specification and part 'B' for limitations and emergencies.
 - 2.1. Questions : 100
 - 2.2. Pass percentage : 70%
 - 2.3. Time allowed : 01 hour 30 minutes
 - 2.4. Validity : 12 months
3. An aggregate of at least 70% must be obtained with a minimum of 80% in part B.

APPENDIX "T"

APPROVED PERSON EXAMINATION (AP-1)

1. Approved Person Examination, paper AP-1: Any person who conducts a test / examination or a flight check on behalf of the Licensing Authority, shall be required to pass AP-1 examination to ensure that he/she has adequate knowledge and understanding of the regulatory work in general, and licensing in particular.
2. **Syllabus** The syllabus of AP-1 Examination shall be as follows
 - 2.1. Chicago Convention.
 - 2.2. ICAO Annex 1.
 - 2.3. CARs1994.
 - 2.4. Air Navigation Orders (pertaining to licensing).
 - 2.5. Air Safety circulars.
3. AP-1 exam will be an open book examination. The paper will comprise of 50 questions with a pass marks of 60%.

APPENDIX "U"

AGRICULTURE RATING EXAMINATION (AG-1)

1. The Agriculture rating examination paper (AG-1): For issue of Agriculture rating an applicant shall pass written Examination of paper AG-1. The paper shall have
 - 1.1. Questions : 50
 - 1.2. Pass percentage : 70%
 - 1.3. Time allowed : 01 hour 30 minutes
 - 1.4. Validity : 24 months

2. **Syllabus**
 - 1.5. Agriculture aircraft pre-flight inspection and pilot maintenance, serviceability of engine and instruments
 - 1.6. Problems associated with low level operations over various type of terrain
 - 1.7. Theoretical aspects of agricultural aviation including types of material sprayed or sown, application rates, application techniques, airspeed versus swath width, meteorological aspects affecting drift environmental responsibilities
 - 1.8. Strip Operations, surface conditions, effect of soft ground, frost and thaw.
 - 1.9. CARs / ASCs / AIP / Rules of the Air