

TOPICS OF COURSES FOR FINAL STATE EXAMINATIONS OF MASTER'S DEGREE PROGRAMME

(for CTU in Prague Faculty of Transportation Sciences students)

Bachelor's Degree Programme: B 3710 – Technology in Transportation and Telecommunications

Study Field 3708R030 – PIL – Professional Pilot

1st compulsory cours: LEGISLATION AND OPERATIONAL REGULATIONS

1. International Law – world organization, European organization, Czech national organization. ICAO – ICAO article, ICAO annex (SAPRS), PANS, regional supplementary procedures.
2. EASA – European competent authority – mission, task, scope, rulemaking, regulations – structure, hard law and soft law.
3. EASA – PART-FCL, PART-MED – competent authority, scope, requirement, structure
4. initial airworthiness, additional airworthiness specifications – introduction, continuing airworthiness – PART-M, PART-ARO
5. Interpretation and analysis ICAO Annexes 2,6,10,11,14,16, ICAO Doc 4444 PANS-ATM, ICAO Doc 8168 – PANS-OPS.
6. definition of risk, risk management – definition and description, risk management – methods and goals, ICAO Doc 9859 - introduction
7. Aerodromes (Annex 14) – code, parameters, RWY and TWY – technical characteristics and parameters, TORA, TODA, ASDA, LDA, aerodrome security and restricted areas, aerodrome reference point.
8. RWY – technical characteristics and parameters, pavement classification number, aircraft classification number, declared distances.
9. Commission Regulation (EU) No. 1321/2014, Annex II - PART-145 – technical requirement, organization, privileges of the organization certifying staff and support staff - personal, maintenance – performance and certification, airworthiness review records, changes in organization, safety and quality
10. Commission Regulation (EU) No. 965/2012 – competent authority in the czech republic, scope of regulation
11. ICAO Annex 19 Safety Management – description, SMS – Safety Management Systems, safety policy, objectives and methods, risk management, safety assurance and safety promotion, safety data collection analysis and exchange

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12. Minimum obstacle clearance and obstacle clearance height.
13. Annex 14 (Aerodromes) – visual aids for navigation – display and signals, markings, lights, signs and markers, Annex 2 (rules of air) – interception of civil aircraft.
14. Commission Regulation (EU) No. 1321/2014, Annex I - PART-M CAMO – scope, application, continuing airworthiness management exposition, personal requirements, documentation, airworthiness review, quality system, record-keeping, findings, change in an organization.
15. Aeronautical Information Service (Annex 15) – introduction, AIP, NOTAM, METAR, integrated aeronautical information package, aeronautical charts.
16. EASA PART-ORO – introduction, requirements, description of compliance monitoring and description of safety management
17. Commission Regulation (EU) No. 1321/2014, Annex III – PART-66 - license categories and subcategories, aircraft groups, application, eligibility, basic knowledge requirements, basic experience requirements, continued validity of the aircraft maintenance license, evidence of qualification.
18. Technical support and infrastructure of aerodrome, approach lighting systems, LVO, visual approach slope indicator systems – PAPI, VASI, aerodrome signs and markers, ecology of aerodromes.
19. ICAO Doc 8168 PANS-OPS – approach procedures – general criteria, arrival and approach segments, missed approach, SID and STAR, minimum obstacle clearance, ACAS – function and operation
20. ICAO Doc 8168 PANS-OPS – Holding Pattern – entry and holding, altimeter settings (QNH, QFE, QNE..)

2nd compulsory subject: (the student opts for one of the following compulsory subjects as part of his/her final oral examination, depending on his/her area of study: Flight Performance and Planning or Aircraft General Knowledge)

A. FLIGHT PERFORMANCE AND PLANNING

1. Masses and balance, centre of gravity, mass and CG limitations, methods of expressing the position of CG of air transport airplanes.
2. Effects of CG position on aircraft stability and controllability. Centre of pressure. CG calculations.

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3. Mass and balance documentation – its contents, responsibility of persons signing the document, allowed changes, EU regulations related to documentation in commercial air operations.
4. Masses used in aviation (BEM, DOM, ZFM, TOM, LM). Procedures and responsibilities for determining fleet masses, aircraft weighing.
5. Standard and actual masses of useful load, crew and operational equipment, associated legislative requirements for airplanes in commercial air operations.
6. Aircraft loading – limitations, handling equipment, goods compatibility, special categories of load. Transport of dangerous goods.
7. Performance – take-off. General principles, take-off distance, performance in climb, factors affecting performance and max./min. take-off speeds.
8. Performance – performance class A. Take-off distance requirements, take-off climb requirements.
9. Performance – cruise. Optimum and maximum level, range, endurance, speeds for maximum performance in cruise, cruise climb, drift-down.
10. Performance – landing. General principles, landing distance and missed approach performance, factors affecting performance and approach speed.
11. Performance – performance class A. Landing distance requirements, missed approach climb gradients.
12. Minimum required fuel according to basic fuel planning procedures in commercial air operations in the EU, its components and calculations.
13. Non-standard fuel planning procedures in commercial air operations – RCF, PDP, isolated aerodromes. In-flight fuel monitoring, procedures if less than the required fuel is on board, declaring an emergency.
14. ICAO ATS flight plan, types of a flight plan, filling in a flight plan, filing a flight plan, closing a flight plan, flight plan deviations.
15. Operational flight plan, contents, aim, use in flight, responsibility for its production and acceptance.
16. Alternate aerodromes, planning and landing minima for IFR flights in commercial air operations in EU except for ETOPS.
17. ETOPS flights – explanation, determining of ETOPS parameters, planning and landing minima of ETOPS en-route alternate aerodromes, ETP, critical fuel.
18. Assessment of weather forecasts in relation to the usability of aerodromes in commercial air operations in the EU – windows of usability, phenomena to be considered and disregarded, differences for different types of approaches, flight planning procedures for aerodromes with forecasts below minima, procedures for flight continuation in the case of weather forecasts/reports below minima.

B. AIRCRAFT GENERAL KNOWLEDGE

1. History and development of aircraft structures.
2. Aircraft classification. Basic structural components and their function.
3. Airplane wings. Construction scheme. Shapes and components. The formation of lift on the wing.
4. De-icing, anti-icing and fire protection systems. Detection systems. Emergency equipment.
5. Lift control. Wing mechanization. Flaps, ground spoilers, speed brakes, ailerons. Increase of lift and drag.
6. Lateral stability and controllability.
7. Airframes. Pressurization. Cabin altitude.
8. Landing gear.
9. Tail plane. Lateral stability and controllability elements.
10. Manoeuvre flight envelope. Gust envelope. Structural loads in operations.
11. Aircraft structure materials.
12. Fuel systems. Oil systems. Power distribution systems.
13. The principle of air instruments.
14. Instrument categorization. Basic principles of instrument and instrument panel design.
15. Engine indicators. Airframe indicators. Compasses.
16. Gyroscopic instruments. Inertial systems.
17. Radionavigation instruments. Transponders.
18. Protection and detection systems. Warning systems.
19. Automatic flight systems and flight envelope protection systems. FMS.

3rd optional subject: (the student opts for one of the following optional subjects which include topics from compulsory or compulsorily optional subjects from the study programme)

A. NAVIGATION

1. Solar system, ecliptic, Kepler's laws. Earth, ellipsoids used in aviation. Coordinate reference systems (Position Reference System-PRS, Cartesian coordinates), their use in air navigation.
2. Aeronautical charts. Projection methods, scale, distortion. SID, STAR, MRVA. Information in final approach chart. En-route chart.

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3. Time, GMT, UTC, civil. Time zones. Speeds used in aviation. (TAS, IAS, CAS, Vat, aircraft approach category). Speed limitations.
4. Nav log for a VFR flight. IFR flight plan. Navigation points.
5. Drift. Triangle of velocities. Relative and absolute bearing. Differences between Heading and course. Magnetic, compass and earth North.
6. Great circle and rhumb lines (formulae for the calculation of great circle distance, initial track, vertices and tracks along the line), plotting of different bearings in the chart.
7. Radionavigation aids NDB/ADF, VOR/DME, ILS. RNAV/RNP
8. PBN concept. Navigation specification. Approach navigation specification.
9. GNS systems. Principles of operation. Advantages, disadvantages and limitations.
10. SBAS. Principles of operation. Advantages, disadvantages and limitations.
11. GBAS. Principles of operation. Advantages, disadvantages and limitations.
12. INS/IRS. Principles of operation. Advantages, disadvantages and limitations.
13. Types of final approaches. Decision minima.
14. RNAV and RNP. Principles of operation. Advantages, disadvantages and limitations.

B. METEOROLOGY

1. Atmosphere – composition, vertical division, temperature, pressure, density, ISA, altitude measurements.
2. Atmospheric pressure systems, atmospheric pressure distribution on the Earth, tropical cyclones.
3. Wind – forces causing wind, gradient and geostrophic wind. Wind shear.
4. Thermodynamics – humidity, change of state of water, adiabatic processes. Air stability and instability.
5. Cloud formation and types of clouds. Visibilities used in aviation. Visibility reducing phenomena, types of fog. Precipitation formation and types.
6. General circulation in the atmosphere, air masses, fronts – definition, types and description.
7. Mid-latitude climate. Tropical climate – ITCZ, monsoons, trade winds, local winds.
8. Icing in flight, accretion, icing conditions, types and shapes, intensity.
9. Turbulence, its origin and types, mountain waves, CAT, turbulence intensity.
10. Thunderstorms – formation, types of thunderstorms, downbursts, tornadoes.
11. Meteorological observations – surface, high-altitude, satellite, radar observations. Weather charts. Differences between Visibility and RVR.

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12. Flight planning information – meteorological reports, forecasts, warnings. Pre-flight meteorological briefing.
13. Dangerous weather phenomena in aviation. CAT, jet stream, microburst etc.

C. COMMUNICATION AND SURVEILLANCE TECHNOLOGY

1. Conventional radionavigation aids for short and medium-range navigation (NDB, VOR/DVOR, DME).
2. Conventional radionavigation approach and landing aids (ILS, MLS)
3. Satellite navigation systems (GPS, GLONASS, Galileo).
4. Augmentation systems (SBAS, ABAS, GBAS).
5. Primary radars (PSR).
6. Secondary surveillance radars (SSR, MSSR, SSR Mode S).
7. Automatic dependant surveillance ADS (ADS-B, VDL Mode-4, 1090 ES, UAT).
8. MLAT (Multilateration) systems – multilateration surveillance systems.
9. Airborne collision avoidance system (ACAS/TCAS).
10. Standards of data transfer in aviation (ACARS, ATN/OSI, ATN/IPS) and their subnetworks (VDL Mode 0/A, VDL Mode 2, High Frequency Data Link (HFDL), Satcom).
11. ATS (Air Traffic Services) air-ground datalink applications (CPDLC, ADS-C, CM).
12. AOC (Airline Operation Communication) air-ground datalink application.
13. Distribution and processing of surveillance data within ATS (SDPS/SDPDS, ASTERIX, SURNET, etc.).
14. RCP (Required Communication Performance) and RSP (Required Surveillance Performance).
15. Data exchange between air traffic services providers (FDPS, OLDI messages, etc.).
16. Data flow between NM (NMOC) and participating users (i.e. aircraft operators, ATSP, ...).
17. Airspace management process (ASM) – individual phases, information exchange and distribution.

D. PRINCIPLES OF FLIGHT

1. Bernoulli theorem and its application to airspeed measurements at low speeds.
2. Reynolds number, critical Reynolds number and its effect on boundary layer separation.
3. Pressure distribution along airfoil depending on the speed of flight, stagnation point.

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4. Pressure distribution on the wing with respect to the wing shape, the effect of wing shape on boundary layer separation, wing twist.
5. Coefficient of lift and drag, aerodynamic effects on the wing tip and the effect of ground proximity.
6. Explain the terms: centre of gravity, neutral point, centre of pressure, moment curves.
7. Stability and controllability.
8. Manoeuvre flight envelope, polar curve.
9. Fixed and variable pitch propellers, effects of slip stream.
10. Turns, force distribution, g-load, effects of altitude.
11. Continuity equation for compressible flow, Mach cone, speed of sound, compressibility, critical Mach number.
12. Effects of compressibility on pressure distribution along the airfoil at high speeds, airfoil for supersonic speeds.
13. Swept wings – comparison with straight wings, area rule, aerodynamic heating.