

TOPICS OF COURSES FOR FINAL STATE EXAMINATIONS
FOR STUDENTS AT FACULTY OF TRANSPORTATION SCIENCES CTU IN PRAGUE
B3710 – TECHNOLOGY IN TRANSPORTATION AND TELECOMMUNICATIONS
STUDY FIELD 3708R031 – LED – AIR TRANSPORT
(valid from 10. 11. 2021)

I. COMPULSORY COURSE

AIRCRAFT GENERAL KNOWLEDGE

1. Aircraft Structures Requirements
2. Loads Applied to Aircraft Structures
3. Airplane Wings (Function and Characteristics)
4. Wing Structure Types (Comparison of Their Properties)
5. Types of Aircraft Propulsion Units
6. Piston Engines (Principle of Operation, Structural Arrangement)
7. Turbine Engines (Principle of Operation, Structural Arrangement)
8. High Altitude Performance Augmentation of Piston Engines (Principle, Supercharger and Turbocharger)
9. Thrust and Useful Mechanical Power of Turbojet Engine, Thermal Efficiency
10. Propeller (Principle of Operation, Propulsive Efficiency)
11. Turbofan Engine of Transport Aircraft (Principle of Operation, Structural Arrangement)
12. Bypass ratio
13. Variation of Propeller and Jet Engine Thrust with Speed and Altitude (Speed and Altitude Characteristics)
14. Variation of Turbine Engine Thrust and Power with RPM (Throttling Characteristics)
15. Types of Fuel and their properties
16. Pressurized Cabins of Transport Aircraft
17. Construction of empennage
18. Airplane Flight Control Systems (Types of Flight Control Systems and Specific Requirements)
19. High Lift Devices and High Drag Devices of Airplanes
20. Aircraft Landing Gear (Types of landing gear and Comparison of Their Properties)
21. Aircraft Technical Documentation
22. Load Factor, Maneuvering Envelope, Gust Envelope
23. Aeroelasticity and its Influence on Aircraft Structures
24. Fatigue Strength of Aircraft Structures

II. COMPULSORY COURSE OPERATIONS AND ECONOMICS IN AIR TRANSPORT

- 1.** World, European and national organizations in civil aviation – scope and powers of individual organizations, nationality of aircraft, aircraft register, civil aircraft marks, air accident investigation.
- 2.** Regulations in civil aviation – European Parliament and Council regulations, Commission (EU) regulations, EU directives and decisions of the executive director of EASA – Acceptable Means of Compliance (AMC) and Guidance Material (GM), examples – Act No. 49/1997 Coll. on Civil Aviation.
- 3.** International conventions – validity, Paris Convention, Warsaw Convention, Rome Convention, Geneva Convention, Tokyo Convention, Haag Convention – Montreal Convention, Chicago Convention – bilateral agreements, freedoms of air – reciprocity.
- 4.** Airspace classification – vertical structure, horizontal structure, provision of ATS services, VFR and IFR rules, controlled and uncontrolled airspace, operations of sport flying devices and UAV.
- 5.** Operational documents – documents on board an aircraft, AOC, maintenance documents, operations manual (OM) – parts and contents.
- 6.** Types of air carriers from an operational-economic point of view – types of competitive strategies, horizontal scope and vertical integration, legacy and low-cost carrier models – regional carrier model – long haul operations – cost models and decision making, monopoly.
- 7.** Airline pricing – fares- organizational aspects of pricing, basic cost structure – pricing and revenue management – minimum and maximum level for price definition – pricing in elastic and inelastic segments – uniform pricing – price differentiation – revenue management.
- 8.** Air transport costs – direct and indirect costs, fixed and variable costs – marginal costs – marginal costs and vertical strategies, revenues from air transport and other revenues.
- 9.** Demand – demand stimulation, demand curve – price elasticity of demand – customer segments and elasticity of demand; basic demand forecast methods in air transport, complements and substitutes – competitive advantages.
- 10.** Dangerous goods transport – regulations and manuals for the transport of dangerous goods, air waybill, aerial work – applicable regulations, helicopter emergency medical services.
- 11.** Handling – technical handling – regulations governing technical handling, commercial handling – regulations governing commercial handling.
- 12.** Aircraft mass – structural masses and their limits, components of these masses, ways of calculating these masses, passenger and baggage masses, aircraft weighing, centre of gravity and aircraft balance – definition of CG, CG calculations, CG position, effects of CG position on stability and fuel consumption, W&B (loadsheets, LIR) document contents, aircraft loading.
- 13.** Take-off – phases of take-off, declared distances, climb – angle of climb and vertical speed, forces acting on an aircraft, V_{mcg} , V_{mca} , V_{ef} , V_1 , V_r , V_2 , V_x and V_y , factors affecting take-off and climb, aircraft performance classes, differences in performance requirements in take-off and climb.
- 14.** Fuel planning – fuel components according to flight phases, minimum fuel requirements, specific fuel planning procedures, requirements on fuel planning for operators, PSR, PNR, TOC, TOD terms.
- 15.** Flight planning – vertical flight profile planning, routes, conditional routes, AUP, meteorological conditions and planning minima, use of weather in flight planning, VFR flight planning, flight log.

16. Flight plan in relation to flight planning – types of flight plans, combination flight plans and their particularities, NMOC communication regarding flight plans, minimum and maximum times for flight plan filing, regulation at non-CDM and CDM airports (differences in flight planning and operational control).
17. Area navigation – PBN, RNAV, RNP terms, waypoints, final approach procedures based on area navigation.
18. Radionavigation – VOR, DME, ILS, NDB principles of operation, ways of expressing direction, definitions of heading, course, variation, deviation.
19. Phases of instrument approaches (arrival routes, initial, intermediate and final approach, missed approach) – where the different phases begin and end, IAF, IF, FAF, FAP abbreviations and their meaning; types of final approach procedures – minima.
20. Navigation – speed – explain the meaning of IAS, CAS, TAS, GS, M, time – local, UTC, GMT, charts – projection methods used in aviation, chart scale, char

III. 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: AIRPORTS AND THEIR DEVELOPMENT OR AIRCRAFT MAINTENANCE OR AIR TRAFFIC CONTROLS AND SYSTEMS)

A. AIRPORTS AND THEIR DEVELOPMENT

1. Basic elements and aerodrome data – Basic elements and definitions, types, reference code, aerodrome data – aeronautical data, aerodrome reference point, aerodrome and runway elevations, aerodrome reference temperature, radio altimeter operating area, aerodrome dimensions and related information
2. Declared distances (RWY) – Declared distances and their meaning, Starter strip, Stopways, Clearways, runway strips, runway shoulders, runway end safety areas
3. Aerodrome pavements and their strength – Types, bearing strength of pavements, designing, measurements
4. Runways - Configuration of the runway system, physical characteristics – length, width, slopes, strength, surface and its structure, calculation of declared distances
5. Taxiways – Configuration of the taxiway system, physical characteristics - length, width, slopes, strength, rapid exit taxiways – characteristics and parameters
6. Condition of the movement area and related facilities, contamination and braking performance – Condition of the movement area and related facilities, aerodrome movement area contamination, contaminant types, runway contamination and related operation limitations, braking performance
7. Aerodrome capacity – Aerodrome capacity, runway and taxiway capacity, capacity of the terminal, solutions for increase of the capacity (infrastructure, ANSP procedures, airline procedures)
8. Low visibility operations – Meteorological condition for declaring LVO, operational minimums for take-off or landing during LVO, requirements for aerodrome equipment, requirements for aircraft equipment, requirements for crew, ANSP operations during LVO
9. Visual aids for navigation – markers, markings and signs – General characteristics (markers, markings and signs), runway markings and signs, taxiway markings and signs, apron markings, runway-holding position marking, intermediate holding position marking, taxiway crossing

10. Aerodrome lights – General characteristics and types, runway lights, taxiway lights, apron lights, runway guard lights, stop bars, intermediate holding position lights
11. Approach lighting system – Application, physical characteristics (dimensions, lights, etc.)
12. Visual approach slope indicator systems – Types, application (PAPI, VASIS), characteristics and description (dimensions, lights, etc.), visual indication, siting
13. Visual aids for denoting obstacles and restricted use areas - Types, characteristics and description, objects that need to be denoted, closed runways, taxiways and aprons, non-load-bearing surfaces, pre-threshold area, unserviceable areas
14. Obstacle limitation surfaces – Types and their characteristics
15. Noise – Legislation, noise protection area, noise-related charges, noise monitoring

B. AIRCRAFT MAINTENANCE

1. History of Aircraft Maintenance
2. Continuing Airworthiness Management Organization (CAMO) – Exposition (CAME), Operation, Structure, Personnel and Facility Requirements, Archives and Records Administration
3. Approved Maintenance Organisation (AMO) – Exposition (MOE), Operation, Structure, Personnel and Facility Requirements, Archives and Records Administration
4. Aircraft Maintenance Engineers – AML Certification, Requirements and Categories, Theoretical and Practical Knowledge, Basic and Type Training
5. Occupational Health and Safety (OHS) – Rules and Procedures
6. Fire and Emergency Instructions – Fire Type and Classes, Electrical Safety Basics, Gas, Oils and Chemical Safety Rules
7. Tooling – Hand Tools, Mechanical Tools, Measuring Equipment
8. Technical Drawings, Diagrams, and Quality Standards
9. Technical documentation – AMM, FM, MRB Report, MPD, CMR, AWL, CMM, SL, SB, AD, IPC, WBM, MMEL, SRM, OHM, WDM, FIM, SSM, NDTM, ITEM, DDG, CDL
10. Aircraft Maintenance – Hard time, On-condition, Condition monitoring
11. Aircraft Weight and Balance – Aircraft Weighting Handbook and Procedures, Aircraft CG and Envelope Curtailment
12. Maintenance Procedures – Responsibilities, Certificate of Release to Service (CRS),
13. Maintenance Quality Control (QMS), Aircraft Components TBO
14. Maintenance Programme – Maintenance Planning Process, Task Cards
15. Troubleshooting – Type, Classification and Elimination of Failures
16. Aviation Occurrences – Inspection after Bird Strike, Tail Strike, Lighting Strike, Hard Landing

C. AIR TRAFFIC CONTROLS AND SYSTEMS

1. Conventional radio-navigation systems – fundamental principal description of NDB/ADF, VOR/DVOR, DME, and its usage
2. Precision approach and landing systems: principal description of the ILS, MLS, GLS – system design; mutual comparison and specifics of usage; ILS restricted areas (critical and sensitive area)

3. Global Navigation Satellite System (GNSS) – GNSS subsystems; ABAS (RAIM) description; architecture and principal description of the SBAS; EGNOS system; principal description of the GBAS
4. Global Positioning System (GPS) – Explanation of GPS positioning principle; pseudorange measurement and errors; PRN codes; signals emitted by GPS satellites; the data message
5. Primary Surveillance Radar (PSR) – classification, types, principle of primary radars. Pulse radars; pulse compression techniques; transmitters and antennas used in aviation radar technology; signal processing (detection, extraction, filtration); doppler processing
6. Secondary Surveillance Radar (SSR Mode A/C, SSR Mode S) – monopulse technique (MSSR); SLS (Side Lobe Suppression) principle; explanation of SSR Mode **S 'All-Call' and 'Roll-Call'** periods; information transmitted within Mode A, C, and Mode S. Use of Mode S data in ATS systems
7. Automatic Dependent Surveillance (ADS) – Difference between ADS-B and ADS-C. 1090 ES technology; information transmitted within ADS-B 1090 ES messages; current use of ADS-B
8. MLAT (WAM) System – Multilateration surveillance system: Target position determination by means of passive MLAT system. Active systems; elliptical-hyperbolic multilateration techniques. Current use of MLAT systems in aviation
9. ACAS (Airborne Collision Avoidance System) / TCAS (Traffic Alert and Collision Avoidance System): Intruder aircraft position determination; types of alerts (TA, RA); presentation of the outputs to aircrew; ACAS carriage mandate
10. PBN - Performance Based Navigation – Area navigation; navigation specification (RNAV, RNP); different required specification for different phases of flight
11. Division and classification of airspace, explanation of terms – Sectorization; Restricted areas (types); FIR; TMA; CTR
12. Flexible Use of Airspace concept – FUA/AFUA, division of GAT/OAT operations, strategic, pretactical and tactical coordination within FUA/AFUA
13. Air Traffic Services – ATS; Functions, division, provided services
14. Air Traffic Control (ATC) process – Basic division of ATC - according to provided services
15. Aeronautical Information Service – AIS, functions, what documents are issued by AIS, basic sources of data for AIS; ANNEX 15; Alerting service - ALRS, function
16. Flight plan – function, content, form, types of flight plan, validity of flight plan
17. Submission and elaboration of flight plan – IFPS functions, approval and distribution of flight plan, work with flight plan
18. EUROCONTROL/NMOC – basic functions, effectiveness, basic NMOC systems, strategic, pretactical and tactical phases of flow control
19. ATS/ATC communication (ground-ground, ground-air) – exchange of ATC messages in connection with flight coordination, ATC messages types
20. Aircraft separation – basic division of aircraft separations; Altitude as a flight parameter - altitude measurement, AMSL, AAL, FL, transition altitudes/levels
21. Basic systems and tools used by ANS of the Czech Republic – Main functions of basic systems, description of APP/ACC workplace - differences