AIRLINE TRANSPORT PILOTS LICENSE

(040 00 00 00 - HUMAN PERFORMANCE AND LIMITATIONS)

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 01 00 00	**HUMAN FACTORS BASIC CONCEPTS**	
040 01 01 00	**Human Factors in aviation** – State that Human Factors training is an ICAO and JAA requirement. – Justify the relevance of Human Factors in aviation.	
040 01 01 01	**Competence and limitations** – Define the roles played by various participants in aviation activities with respect to flight safety and the limitations of individuals and organisations in the improvement to flight safety.	
040 01 01 02	**Becoming a competent pilot** – Describe the general classification of the factors to be considered in assessing the competency of any individual pilot. – Outline the factors in training that will ensure the future competency of the individual pilot, e.g. the relationship between self-confidence and expertise.	
040 01 02 00	**Accident statistics** – Give an estimate of the accident rate in commercial aviation in comparison to other means of transport. – State in general terms the percentage of aircraft accidents which are caused by human factors and commonly described as 'pilot error'. – Name the major single cause for a pilot induced accident. – Summarise the accident trend in modern aviation.	

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JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 01 02 00	– Identify the role of accident statistics in developing a strategy for future improvements to flight safety. – Name the most significant item of technical equipment introduced in the 1980s and 1990s which has contributed to the reduction of accidents.	
040 01 03 00	**Flight safety concepts** – Analyse the flight accident statistics and point out the proportion of human error. Discuss its implication for flight safety concepts. – Indicate the importance of error detection and list various methods of detection. – Explain the importance for flight safety of understanding the causes and categories of accidents and incidents. – Describe and compare the elements of the SHELL model. – Summarise the relevance of the SHELL model to work in the cockpit. – Analyse the interaction between the various components of the SHELL model. – Explain how the interaction between individual crew members can affect flight safety. – Identify and explain the interaction between flight crew and management as a factor in flight safety.	
040 02 00 00	**BASIC AVIATION PHYSIOLOGY AND HEALTH MAINTENANCE**	
040 02 01 00	**Basics of flight physiology** – List those factors which may affect the normal working of the human body when in flight.	

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JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 01 01	**The atmosphere** – State the units used in measuring total and partial pressures of the gases in the atmosphere. – State in terms of % and mm Hg the values of Oxygen, Nitrogen and other gases present in the atmosphere. – State that the volume percentage of the gases in ambient air will remain constant for all altitudes at which conventional aircraft operate. – State the physiological significance of the following Laws and be able to carry out calculations using those laws: - Boyle's Law - Dalton's Law - Henry's Laws - The General Gas Law – State the ICAO standard temperature at Mean Sea Level and the Standard Temperature Lapse Rate. – State at what altitudes in the standard atmosphere the atmospheric pressure will be 1/4, 1/3 and 1/2 of MSL pressure. – State the effects of increasing altitude on the overall pressure and partial pressures of the various gases in the atmosphere. – Explain the differences in gas expansion between alveolar and ambient air when climbing. – State the condition required for human beings to be able to survive at any given altitude. – With regard to respiration, identify the most important gases of the atmosphere.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 01 02	**Respiratory and circulatory systems** – List the main components of the respiratory system and their function. – Identify the different volumes of air in the lungs which are important for determining pulmonary function. – State the values for the normal rate of breathing and the volume of air exchanged with each normal breath ('tidal volume'). – State how oxygen and carbon dioxide are transported throughout the body. – Explain the process by which oxygen is transferred to the tissues and carbon dioxide is eliminated from the body. – Explain the role of carbon dioxide in the control and regulation of respiration. – Describe the process of inhalation and exhalation ('external respiration') and the metabolism of carbohydrates in the body ('internal respiration'). – List the factors determining pulse rate. – Name the major components of the circulatory system and describe their function. State the values for a normal pulse rate and the average cardiac output (heart rate x stroke volume) of an adult at rest. – Name the four chambers of the heart and state the function of the individual chambers. – Differentiate between arteries, veins, and capillaries in their structure and function. – State the functions of the coronary arteries and veins.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 01 02 (continued)	– State the function ofcarotid and aortic sinus pressoreceptors. – Define 'systolic' and 'diastolic' blood pressure and give standard values for an adult at rest. – State the normal blood pressure ranges and units of measurement. – Classify the effects of age on normal blood pressure range. – List the symptoms of a person in circulatory shock. – List the composition of the blood and the purpose of the constituent parts. – Explain the function of the hemoglobin and state the percentage of oxygen saturated in the blood at MSL and at 10,000 ft. – Indicate the effect of increasing altitude on hemoglobin oxygen saturation. – Define the following terms associated with failures in the respiratory/circulatory systems and analyse their significance for the conduct of a safe flight: – Hypoxia - Define 'hypoxia' and state why living tissues require oxygen. - State that healthy people are able to compensate for altitudes up to 10 - 12,000 ft. - Identify at least three conditions causing hypoxia in flight. - List the signs and symptoms of hypoxia, define their characteristics and determine their role in flight safety. -Name the three physiological thresholds and allocate the corresponding altitudes for each of them. - State the altitude at which short term memory begins to be affected by hypoxia.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 01 02 (continued)	- Define the terms 'Time of Useful Consciousness' (TUC) and 'Effective Performance Time' (EPT). - State the TUC for 20,000 ft, 30,000 ft, 35,000 ft and 43,000 ft for a person at rest and for 25,000 ft when the person is moderately active. - Explain why it is unsafe to fly above 10 - 12,000 ft without using additional oxygen or being in a pressurised cabin. - List the factors determining the severity of hypoxia. - State the precautions to be taken when giving blood. - State the equivalent altitudes when breathing ambient air and 100% oxygen for MSL, 10,000 ft, 35,000 ft, and 38,000 ft. – Hyperventilation - Describe the role of carbon dioxide in hyperventilation. - Describe the effects of hyperventilation on the acid-base balance of the blood, the capacity of the hemoglobin to transport oxygen and the supply of oxygen to the cells. - Define the term 'hyperventilation'. - List the factors causing hyperventilation. - List the signs and symptoms of hyperventilation and define their charactersitics. - Identify symptoms of hyperventilation for given flight conditions. - Describe the effects of hyperventilation on muscular coordination. - List measures which may be taken to counteract hyperventilation.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 01 02 (continued)	– Decompression Sickness - State the normal range of cabin pressure altitude in pressurised commercial aircraft and describe their protective function for aircrew and passengers. - Identify the causes of decompression sickness in flight operation. - State how decompression sickness can be prevented. - State the threshold for the onset of decompression sickness in terms of altitude. - List the symptoms of decompression sickness. - Indicate how decompression sickness symptoms may be treated. - List the vital actions the crew has to perform when cabin pressurisation is lost. - Define the hazards of diving and flying and give the regulations associated with these activities. – Acceleration - Define 'linear', 'angular' and 'radial acceleration'. - Describe the effects of acceleration on the circulation and blood volume distribution. - List the factors determining the effects of acceleration on the human body. - Describe measures which may be taken to increase tolerance to positive acceleration. - List the effects of positive acceleration with respect to type, sequence and the corresponding G-load. – Anaemic hypoxia - Define 'anaemia'. - State how carbon monoxide may be produced.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- State how the presence of carbon monoxide in the blood affects the distribution of oxygen. - List the signs and symptoms of carbon momoxide poisoning. - Indicate how carbon monoxide intoxication can be treated.	
040 02 01 03	**<u>High altitude environment</u>** – Ozone - State how an increase in altitude may change the proportion of ozone in the atmosphere. - List the possible harmful effects of ozone. - List the means by which the effects of ozone may be counteracted. – Radiation - State the sources of radiation at high altitude. - List the effects of excessive exposure to radiation. - State the effect of sun storms on the amount of radiation at high altitude. - List the harmful effects that may result from the extra radiation that may be generated as the result of a sun storm (solar flares). - List methods of reducing the above effects. – Humidity - Define the terms ‘humidity’ and ‘relative humidity’. - List the factors which affect the relative humidity of both the atmosphere and cabin air.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- State the methods of reducing the effects of excessive or insufficient humidity. - List the physiological effects of dry cabin air on the human body and indicate measures to diminish these effects. – Extreme Temperatures - Explain the change in the need for oxygen of the human body when exposed to extreme environmental temperatures.	
040 02 02 00	**<u>Man and environment: the sensory system</u>** – List the different senses. – State the multi-sensory nature of human perception.	
040 02 02 01	**Central and peripheral nervous system** – Name the main parts of the central nervous system. – State the basic functions of the central nervous system. – State that the main functions of the brain are to process information from sensory input and to generate cognitive processes using retained information from memory. – State the part that the cerebellum plays in balance and coordination. – Define the division of the peripheral nerves into sensory and motor nerves. – State that a nerve impulse is an electro-chemical phenomenon.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Define the term ‘sensory threshold. – Define the term ‘sensitivity’, especially in the context of vision. – Give examples of sensory adaptation. – Define the term ‘habituation’ and state its implication for flight safety. – State the basic functions of the autonomous (vegetative) nervous system. – Define biological control systems as neuro-hormonal processes that are highly self regulated in the normal environment. – Define the reaction called 'reflex'.	
040 02 02 02	**Vision** – Name the most important parts of the eye and the pathway to the visual cortex. – State the basic functions of the parts of the eye. – Define 'accommodation'. – State the effect of speed on the function of the photosensitive cells. – Distinguish between the functions of the rod and cone cells. – Describe the distribution of rod and cone cells in the retina and explain their relevance on perception. – Explain the terms ‘visual acuity’, ‘visual field’, ‘central vision’, ‘peripheral vision’, 'fovea' and explain their function in the process of perception. – List the factors which may degrade visual acuity.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– State the limitations of night vision. – Explain the adaptation mechanism in vision to cater for reduced levels of illumination. – State the time necessary for the eye to adapt to the dark. – State the effect of hypoxia and smoking on night vision. – Explain the basic principles of colour vision and their relevance to flight duties. – Explain the nature of colour blindness. – Distinguish between monocular and binocular vision. – Explain the basis of depth perception and its relevance to flight performance. – List possible monocular cues for depth perception. – State the problems of vision associated with higher energy blue light and ultra violet rays.	
040 02 02 03	**Hearing** – State the audible range of the human ear. – State the unit of measure for the intensity of sound. – Name the most important parts of the ear and the associated neural pathway. – State the basic functions of the different parts of the auditory system. – Differentiate between the functions of the vestibular apparatus and the cochlea in the inner ear. – Define the main causes of the following hearing defects: - 'Conductive deafness'	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- 'Noise Induced Hearing Loss' (NIHL) - 'Presbycusis'. – Summarise the effects of environmental noise on hearing. – State the decibel level of received noise that will cause NIHL. – Indicate the factors, other than noise level, which may lead to NIHL. – Identify the potential occupational risks which may cause hearing loss. – State the role of the Eustachian tube in equalizing pressure between the middle ear and the environment Indicate the effects of colds or flu on the ability to equalize pressure in the above.	
040 02 02 04	**Equilibrium** – List the main elements of the vestibular system. – State the functions of the vestibular organ on the ground and in flight. – Distinguish between the component parts of the vestibular system in the detection of linear and angular acceleration as well as on gravity. – Explain how the semicircular canals are stimulated. – Describe air-sickness and its accompanying symptoms. – Indicate the range (Hertz) where vibration can cause undesirable human responses because of the resonance of the skull and the eyeballs. – List the causes of motion sickness. – Describe the necessary actions to be taken to counteract the symptoms of motion sickness.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 02 05	**Integration of sensory inputs** – State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight.	
040 02 02 05 (continued)	– Define the term 'illusion'. – Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons and surface planes; – Relate these illusions to problems that may be experienced in flight and identify the danger attached to them. – State the conditions which cause the 'black hole' effect and 'empty field myopia'. – Give examples of approach and landing illusions, state the danger involved and give recommendations to avoid or counteract these problems. – State the problems associated with flickering lights (strobe-lights, anti-collision lights, etc.) – List the type of external stimuli that the components of the inner ear are able to perceive. – Give examples of vestibular illusions such as somatogyral, coriolis, somatogravic, and g-effect illusions as well as inversion and 'the leans'; – Relate the above mentioned vestibular illusions to problems encountered in flight and state the dangers involved. – Be familiar with oculogyral and oculogravic illusions and the associated risks involved in flight. – List and describe the function of the proprioceptive senses ('Seat-of-the Pants-Sense').	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Relate illusions of the proprioceptive senses to the problems encountered during flight. – State that the 'Seat-of-the-Pants-Sense' is completely unreliable when visual contact with the ground is lost or when flying in IMC. – Define 'vertigo', list the corresponding symptoms and identify the flight maneuvers provoking it. – Differentiate between vertigo, coriolis effect and spatial disorientation. – Explain flicker-vertigo and give counter measures. – Explain how spatial disorientation can result from a mismatch in sensory input and information processing. – List the measures to prevent and/or overcome spatial disorientation and/or vertigo in flight.	
040 02 03 00	**Health and hygiene**	
040 02 03 01	**Personal hygiene** – Summarise the role of personal hygiene as a factor in human performance.	
040 02 03 02	**Common minor ailments** – List the negative effects of suffering from colds or flu on flight operations especially with regard to the middle ear, the sinuses, and the teeth. – Explain the effects of pressure changes to structures in the ear and the implications of these effects.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– State the role of the Eustachian tube in equalizing pressure between the middle ear and the environment. – Indicate the effects of colds or flu on the ability to equalize pressure between the middle ear and the environment. – Describe the measures to prevent and/or clear problems due to pressure changes during flight. – Define 'Barotrauma'. – Indicate the major sources of gastro-intestinal upsets , state the effects that may result during flight and list the precautions that should be observed to reduce the occurence of these problems.	
040 02 03 03	**– Problem areas for pilots** – Hearing loss - List the main cause of hearing loss. - List the main sources of hearing loss in the flying environment. - List the precautions that may be taken to reduce the probability of onset of hearing loss. – Defective vision - List the major causes of defective vision in: - Long sightedness (Hypermetropia) - Short sightedness (Myopia) - Presbyopia	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 03 03 (continued)	- Cataracts - Glaucoma - Astigmatism. - State the corrective action necessary to compensate for defective vision. - Differentiate between the corrective lenses for long/short sightedness. - List the type of sunglasses which could cause perceptional problems in flight. - List the measures which may be taken to protect oneself from flashblindness. - State the possible effects that low relative humidity may have on the efficient functioning of the eye. – Techniques in visual perception - Define the term 'scanning technique'. - Explain, why it is important to visually scan the area by using regularly spaced eye movements each covering an overlapping sector of about 10 degrees. - State the rule, at present in force, for the wearing of corrective spectacles or contact lenses when operating as a pilot. - Describe the requirements of good sunglasses beeing used in modern 'glass cockpits'. - State the duration of a saccade (dwelling time) while performing the outside visual scan. - Explain the difference between the scanning technique used during the day and the appropriate technique to be used when flying at night. - Describe the significance of the 'blind spot' on the retina in detecting other traffic in flight.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 03 03 (continued)	- State the effect that the duration of a saccade has on determining scanning patterns both inside and outside the cockpit. – Hypo- and Hypertension - Define 'hypotension'. - List the effects that low blood pressure may have on some normal functions of the human body. - Define 'hypertension'. - List the effects that high blood pressure will have on some normal functions of the human body. - State that hypotension as well as hypertension may disqualify the pilot from obtaining a medical clearance to fly. - List the factors which can lead to hypertension in an individual. - State the corrective actions that may be taken to reduce high blood pressure. - Stress that hypertension is the major factor in ‘strokes’ in the general population. – Coronary disease - Differentiate between ‘angina’ and ‘heart attack’. - List the major factors that may make an individual vulnerable to a heart attack. - State the techniques that may be used to control or reduce the effect of coronary disease. - State the role played by physical exercise in reducing the chances of developing coronary disease. - List the symptoms of a person in circulatory shock. – Obesity	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- Define 'obesity'. - State the cause of obesity. - State the harmful effects of obesity on: - Possibility of developing coronary problems - Increased chances of developing diabetes - Ability to withstand g forces - The development of problems with joints of the limbs - General circulation problems - Higher risk of developing gout - Ability to cope with hypoxia or DCS - State the relationship between obesity and Body Mass Index (BMI). - Calculate the BMI of an individual (given weight in Kg and height in metres) and state whether this BMI indicates that the individual is underweight, overweight, obese or within the normal range of body weight. – Nutrition hygiene - State the major constituents of a healthy diet. - State the measure to avoid hypoglycamia. - State the role vitamins and trace elements are playing in a healthy diet. - List the major contaminating sources in foodstuffs. - State the actions to be taken to avoid food contamination.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 03 03 (continued)	– Tropical climates - List the problems associated with operating in tropical climates. - State the possible causes/sources of incapacitation in tropical or poorly developed countries with reference to: - Standards of hygiene - Quality of water supply - Insect-borne diseases - Parasitic worms - Rabies or other diseases that may be spread by contact with animals. - State the precautions to be taken to reduce the risks of developing problems in tropical areas. – Epidemic diseases - State the major epidemic diseases that may kill or severely incapacitate individuals. - State which preventative hygenic measures, vaccinations, drugs, and other measures, reduce the chances of catching these diseases. - State the precautions which must be taken to ensure that disease carrying insects are not transported between areas.	
040 02 03 04	**– Intoxication** – Tobacco	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- State the harmful effects of using tobacco on:	
	- The respiratory system	
	- The cardio-vascular system	
	- The ability to resist hypoxia	
	- The ability to tolerate g forces	
040 02 03 04	- Night vision	
(continued)	– Caffeine	
	- Indicate the level of caffein dosage at which performance is degraded.	
	- Besides coffee, indicate other beverages containing caffeine.	
	– Alcohol	
	- Give a general rule governing flying and drinking alcohol.	
	- State the effects of consuming alcohol on:	
	- Ability to reason	
	- Inhibitions and self control	
	- Vision	
	- Sense of balance and sensory illusions	
	- Sleep patterns	
	- Hypoxia	
	- State the effects alcohol may have if consumed together with other drugs.	
	- Identify the WHO definition of ‘alcoholism’.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 02 03 04 (continued)	- List the signs and symptoms of alcoholism. - List the factors which may be associated with the development of alcoholism. - Define the 'unit' of alcohol and state the most effective factor determining the rate of metabolisation. - State the maximum daily and weekly intake of units of alcohol which may be consumed without causing damage to organs and systems in the body. - State the actions to be taken if a crew member is suspected of being an alcoholic. – Drugs and self medication - State the dangers associated with the use of non prescription drugs. - State the side affects of common non prescription drugs used to treat colds, flu, hay fever and other allergies especially medicines containing anti-histamine preparations. - Interpret the general rule that 'if a pilot is so unwell that he/she requires any medication then he/she should consider him/herself unfit to fly.	
	– Toxic materials - List those materials present in an aircraft which may, when uncontained, cause severe health problems.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- State the dangers of mercury spillage in an aircraft. - List the possible sources of mercury in an aircraft. - List those aircraft component parts which if burnt may give off toxic fumes.	
040 02 03 05	**Incapacitation in flight** – State that incapacitation is most dangerous when its onset is insidious. – List the major causes of in-flight incapacitation. – Differentiate between 'fits' and 'faints'. – State how EEG tracings may indicate a person's susceptibility to fits. – Indicate the benefit of procedural simulator training which will qualify the crew to recognize and promptly react upon incapacitation of either crew member, should it occur in flight.	
040 03 00 00	**BASIC AVIATION PSYCHOLOGY**	
040 03 01 00	**Human information processing**	
040 03 01 01	**Attention and vigilance** – Differentiate between 'attention' and 'vigilance'.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 01 01 (continued)	– Define 'hypovigilance'. – Identify the factors which may affect the state of vigilance. – List the factors that may forestall hypovigilance during flight. – Indicate signs of reduced vigilance. – Name factors that affect a person's level of attention. – Distinguish between selective and divided attention. – Discuss the effects of performing simultaneous tasks in respect to the level of consciousness involved and demonstrated level of performance. – Discuss consequences for work in a multi-task environment, bearing attention and vigilance in mind. Name procedures which increase safety.	
040 03 01 02	**Perception** – Name the basis of the perception process. – Descibe the mechanism of perception ('bottom-up'/'top-down' process) – Illustrate why perception is subjective and state the relevant factors which influence interpretation of perceived information. – Describe some basic perceptual illusions. – Illustrate some basic perceptual concepts and laws. – Give examples where perception plays a decisive role in flight safety.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 01 03	**Memory** – List the three types of memory. – Explain the link between the three types of memory. – Describe the differences between the three types of memory in terms of capacity and retention time.	
040 03 01 03 (continued)	– Justify the importance of sensory store memories in processing information. – State the average maximum number of separate items that may be held in working memory.	
(continued)	– Give examples of items that are important for pilots to hold in working memory during flight. – Describe how the capacity of the working memory store may be increased. – State the sub-divisions of long term memory and give examples of their content. – Define the three different categories of information stored in long term memory. – Name the common problem with long term memory and how to counteract it.	
040 03 01 04	**Response selection** – Define 'learning'. – Explain and distinguish between the following basic forms of learning: - Classical and operant conditioning (behaviouristic approach) - Learning by insight (cognitive approach) - Learning by imitating (modeling).	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Find pilot related examples for each of these learning forms. – State factors which are necessary for and promote the quality of learning. – Explain ways to facilitate the memorization of information by the following learning techniques: - Mnemonics - Mental training	
040 03 01 04 (continued)	– Explain the relationship between motivation and learning, performance, and attention – Describe the advantage of planning and anticipation of future actions. – Define the term 'skills'. – State the phases of learning a skill (ANDERSON). – Explain the term 'motor-programme' or 'mental schema'. – Explain the following phases in connection with the aquisition of automated behaviour: - Cognitive phase - Associative phase - Automatic phase. – Describe the advantages and disadvantages of mental schemata. – Explain the model by RASMUSSEN which describes the guidance of a pilot's actions in different situations. – State possible problems or risks associated with skill-based, rule-based, and knowledge-based behaviour.	
040 03 02 00	**<u>Human error and reliability</u>**	

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JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 02 01	**Reliability of human behaviour** – Summarise the current approach to human error in aviation. Identify the consequences in respect of the current approach. – Name and explain factors which influence human reliability.	
040 03 02 02	**Hypotheses on reality** – Cite examples of the relationship between perception and reality in given circumstances. – List factors which influence one's sense of reality. – Define the term 'mental model' in relation to a surrounding complex situation. – Describe the advantage/disadvantage of mental models. – Explain the relationship between personal 'mental models' and the creation of cognitive illusions.	
040 03 02 03	**Theory and model of human error** – Define the term 'error'. – Explain the concept of the error chain. – Differentiate between an isolated error and an error chain. – State examples of an isolated error and an error chain.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Distinguish between different forms/types of errors (e.g. RASMUSSEN, REASON). – Compare unintended and intended deviations from standards, leading to negative consequences. – Distinguish between an active and a latent error and give examples.	
040 03 02 04	**Error generation** – Distinguish between internal and external factors in error generation – Identify possible sources of internal error generation. – Define the term 'environmental capture'. – Define the term 'deterioration effect'. – List the three main sources for external error generation. – Give examples to illustrate the following factors in external error generation in the cockpit: - Ergonomics - Economics - Social environment. – Name major goals in the design of human centred man-machine interfaces. – Define the term 'error tolerance'. – List (and describe) strategies which are used to reduce human error.	

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JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 03 00	**Decision making** – Define the term 'deciding' and 'decision making'.	
04 03 03 01	**Decision making concepts** – Describe the major factors on which a decision-making should be based during the course of a flight ('Judgement Concept'). – Describe the main positive capabilities in an individual's decision making mechanism. – Describe the main error sources and limits in an individual's decision making mechanism. – State the factors upon which an individual's risk assessment is based. – Explain the relationship between risk assessment, commitment, and pressure of time on decision making strategies. – Describe the positive and negative influences exerted by other group members on an individual's decision making process. – Explain the general idea behind the creation of particular models' guidelines for decision making processes. – Illustrate a practical approach for decision making between crew members.	
040 03 04 00	**Avoiding and managing errors: cockpit management**	

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JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 04 01	**Safety awareness** – Justify the need for being aware of one's own performance before and during a flight and possible consequences of its result as part of a pilot's professionalism.	
040 03 04 01 (continued)	– Define the term 'situation(al) awareness'. – Name the three cognitive elements which are necessary to create an adequate situation awareness. – Identify factors which interfere with being 'situationally aware'. – List cues which indicate the loss of situation awareness. – Name the main steps towards regaining lost situation awareness. – Justify the value of situation awareness in the context of flight safety	
040 03 04 02	**Co-ordination (multi-crew concept)** - Name the objectives of the multi-crew concept. - State and explain the elements of multi-crew concepts. - Explain the concept ”Standard Operating Procedure” (SOP). - Illustrate the purpose and procedure of crewbriefings. - Illustrate the purpose and procedure of checklists. - Compare the team coordination during the flight training phase and commercial flight operation. - Describe the function of communication in a coordinated team.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 04 03 **040 03 04 03 (continued)**	**Co-operation** – Distinguish between co-operation and co-action. – Define the term 'group'. – Illustrate the influence of interdependence in a group. – List the advantages and disadvantages of team work. – Explain the term 'synergy'. – Define the term 'cohesion'. – Define the term 'groupthink'. – Define the term ‘risky shift’. – State the essential conditions for good teamwork. – Explain the function of role and norm in a group. – Name the different role patterns which occur in a group situation. – Explain how behaviour can be affected by the following factors: - Persuasion - Conformity - Compliance - Obedience. – Distinguish between status and role.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the terms ‘leadership’ and 'followership’. – Describe the trans-cockpit authority gradient and its affiliated leadership styles. – Illustrate different leadership styles (BLAKE & MOUTON) and judge their influence on communication patterns and behaviour of crew members. – Name the most important attributes for a positive leadership style. – Explain the duty and role of the Pilot in Command (PIC). – Explain the duty and role of the First Officer (FO) and other crew members.	
040 03 04 04	**Communication** – Explain the function and measurement of 'information'. – Define the term 'communication'. – List the four most basic components of interpersonal communication (e.g., BERLO). – Explain the advantages of two-way communication as opposed to one-way communication. – Interpret the statement "One cannot not communicate." (Watzlawick). – Distinguish between verbal and non-verbal communication. – Name the functions of non-verbal communication. – Describe general aspects of non-verbal communication. – Explain the various levels of communication (SCHULZ VON THUN):	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- Factual level - Appeal level - Self-disclosure level - Relation level.	
040 03 04 04 (continued)	– Describe the advantages/disadvantages of implicit and explicit communication. – State the attributes of a 'professional' language. – Name practical interpersonal communication rules to obtain and maintain a good grasp of the situation (picture). – Name and explain major obstacles to effective communication. – Construct examples for misunderstandings arising from inadequate communication in the cockpit. – Explain the effect of incompatibility on the difference between verbal and non-verbal communication. – Explain the difference between intra- and interpersonal conflict. – Describe the escalation process in a destructive conflict. – List typical consequences of conflicts between crew members. – Explain the following terms as part of communication practice in regard to preventing or solving conflicts: - Inquiry - Active listening - Advocacy - Feedback	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	- Metacommunication - Negotiation - Arbitration. –	
040 03 05 00 **040 03 05 01**	**Personality** **Personality and attitudes** – Describe the factors which determine an individual's behaviour. – Define and distinguish between personality, attitude, and behaviour. – State the origin of personality and attitutes. – Summarise the influence of pilot relevant personality traits and dangerous attitudes on pilots' performance in the cockpit environment.	
040 03 05 02	**Individual differences in personality** – Describe the individual differences in personality by the mean of a common trait model (e.g., EYSENCK's personality factors) and use it to describe today's ideal pilot. – State the most important personality trait for effective crew decision making. – Motivation	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 05 02 (continued)	- Define motivation. - Explain the influences of different level of motivation on performance in taking into consideration arousal and task difficulty. - Explain the 'Model of human needs' (MASLOW). - Distinguish between the stages of the 'Model of human needs' by citing practical examples. - Illustrate the influence of human needs on flight safety. - Explain the basic model that identifies two independent sources of motivation; justify its conclusion on possible developments concerning an individual's job satisfaction. - Summarise the advantages and disadvantages of extreme need for achievement. – Self-concept - Define the term 'self-concept'. - Decribe the likely influence of promotion (e.g., FO to Cpt) on an individual's self-concept. – Self-discipline - Define 'self-discipline' and justify its importance for flight safety. – Summarise examples of mental states and behaviour endagering flight safety.	
040 03 05 03	**<u>Identification of hazardous attitudes (error proneness)</u>** – Name those hazardous mental attitudes, which, if prevalent in a crew member, might represent a hazard to	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	flight safety. – Describe the signs of mental attitudes and behaviour patterns in a flight crew member, which might be hazardous to flight safety. – Describe the mental attitude and behaviour patterns of an ideal crew member. – Summarise how a person's basic attitude influences his work in the cockpit.	
040 03 06 00 **040 03 06 01**	**Human overload and underload** **Arousal** – Explain the term 'arousal'. – Describe the relationship between arousal and performance. – Understand the graphical representation of the above relationship.	
040 03 06 02	**Stress** – Explain the term 'homeostasis'. – Explain the term 'stress'. Why is stress a natural human reaction. – State that the physiological response to stress is generated by the ‘fight or flight’ response. – Describe the function of the autonomic nervous system (ANS) in stress response.	

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(040 00 00 00 - HUMAN PERFORMANCE AND LIMITATIONS)

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 06 02 (continued)	– Explain the biological reaction to stress by means of the 'general adaptation syndrom' (GAS). – Explain the relationship between arousal and stress by refering to the effects of "good" and "bad" stress. – State the relationship between stress and performance. – Explain the differences between stress factors and stress reactions. – State the basic categories of stress factors. – Name major stress factors. – List the major environmental sources of stress in the cockpit. – State the acceptable amount of workload with regard to crew resources available, before it becomes an unacceptable stress factor. – Name the principal causes of domestic stress. – State that the stress experienced as a result of particular demands varies between individuals. – Explain the process which is responsible for the individual differences in experiencing stress. – Explain the difference between stress factors and risk factors. – List factors influencing the tolerance of stressors. – Create and explain a simple model of stress. – Explain the relationship between stress and anxiety. – Describe the effects of anxiety on human performance. – State the general effect of acute stress on the human system. – Name the symptoms of stress relating to the different phases of the GAS.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 06 02 (continued)	– Describe the relationship between stress, attention, and vigilance. – State the general effect of chronic stress on the human system. – Explain the differences between psychological, psychosomatic and somatic stress reactions. – Name typical common physiological and psychological symptoms of human overload. – Describe effects of stress on the personality. – Explain how stress is cumulative and how stress from one situation can be transferred to a different situation. – Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future. – List sources and symptoms of human underload. – Describe the effect of human under/overload on effectiveness in the cockpit.	
040 03 06 03	**Fatigue** – Explain the term 'fatigue' and differentiate between the two types of fatigue. – Name causes for both types. – Identify symptoms and describe effects of fatigue.	
040 03 06 04	**Body rhythms and sleep** – Name some internal body rhythms.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 06 04 (continued)	– Explain the term 'circadian rhythm'. – State the approximate duration of a 'free-running' circadian rhythm. – Explain the significance of 'Zeitgebers' in regulating the normal circadian rhythm. – State the effect of the circadian rhythm of body temperature on an individual's performance standard and the effect on an individual's sleep patterns. – List and describe the stages of a sleep cycle. – Differentiate between REM and non-REM sleep. – Explain the function of sleep and describe the effects of insufficient sleep on performance. – Explain the simple calculations for the sleep/wake credit/debit situation. – Explain how sleep debt can become cumulative. – State the time formula for the adjustment of body rhythms to the new local time scale after crossing time zones. – State the problems caused by circadian disrhythmia (jet-lag) on an individual's performance and sleep sequence. – Differentiate between the effects of westbound and eastbound travel. – Explain the interactive effects of circadian rhythm and vigilance on a pilot's performance during flight as the duty-day elapses. – Describe the main effects of lack of sleep on an individual's performance. – List possible coping strategies for jet-lag.	

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(040 00 00 00 - HUMAN PERFORMANCE AND LIMITATIONS)

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
040 03 06 05	**Fatigue and stress management** – List strategies which prevent or delay the onset of fatigue and hypovigilance. – List and describe coping strategies for dealing with stress factors and stress reactions. – Distinguish between short-term and long-term methods of stress management. – Give examples of short term methods of stress management. – Give examples of long-term methods of coping with stress.	
040 03 07 00	**Advanced cockpit automation** – Define and explain the basic concepts of automation.	
040 03 07 01	**Advantages and disadvantages ("criticalities")** – List the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situational awareness, and crew coordination. – State the advantages and disadvantages of the two components of the man-machine system with regard to information input and processing, decision making, and output activities. – Explain the "ironies of automation". – Give examples of methods to overcome the disadvantages of automation.	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Interpret the present philosophy on automation with regard to the usage of automated systems by available man-machine interfaces and pilots' duties.	
040 03 07 02	**Automation complacency** – State the main weaknesses in the monitoring of automatic systems. – Explain the following terms in connection with automation: - Passive monitoring. - Blinkered concentration. - Confusion. – Give examples of actions which may be taken to counteract ineffective monitoring of automatic systems. – Define 'complacency'**.**	
040 03 07 03	**Working concepts** – Analyse the influence of automation on crew communication and describe the potential disadvantages. – Summarise how the negative effects of automation on pilots may be alleviated. – Interpret the role of automation with respect to flight safety	