INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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AERONAUTICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	AIRCRAFT PROPULSION
Course Code	:	AAE007
Program	:	B.Tech
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Branch	:	Aeronautical Engineering
Section	:	A&B
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Course Faculty	:	Dr. Maruthupandiyan K, Associate Professor Dr. Prashant G K, Associate Professor

OBJECTIVES:

I	To help students to consider in depth the terminology and nomenclature used in the syllabus.
II	To focus on the meaning of new words / terminology/nomenclature

DEFINITIONS AND TERMINOLOGYQUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
UNIT-I						
1	Define bypass ratio.	The bypass ratio (BPR) of a turbofan engine is the ratio between the mass flow rate of the bypass stream to the mass flow rate entering the core.	Remember	CO1	CLO 1	AAE007.01
2	Define air breathing engine.	Engine which utilizes the atmospheric air for its combustion process.	Understand	CO1	CLO 1	AAE007.01
3	Define specific impulse.	It is defined as the thrust produced per unit rate of consumption of the propellant.	Remember	CO1	CLO 1	AAE007.01
4	Define specific fuel consumption	The specific fuel consumption of an engine is the rate of fuel burnt to produce a unit of thrust.	Understand	CO1	CLO 1	AAE007.01
5	Define propulsive efficiency.	It is the measure of how effectively the engine power is used to power the aircraft. It is defined as the ratio of the aircraft power to the power output of engine.	Remember	CO1	CLO 2	AAE007.02
6	Define thermal efficiency	It is defined as ratio of net rate of energy output by the engine to the rate of thermal energy available from the fuel.	Remember	CO1	CLO 4	AAE007.04

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
7	Define specific thrust	Specific thrust is the thrust produced per unit air mass flow rate of a jet engine.	Understand	CO1	CLO 5	AAE007.05
8	Define range.	Maximum distance that an aircraft can travel for single filling of fuel is called range.	Remember	CO1	CLO 6	AAE007.06
9	Define endurance	Maximum time that an aircraft can stay in air for single filling of fuel is called endurance.	Remember	CO1	CLO 7	AAE007.07
10	Define thrust	Thrust is a mechanical force generated by the engine to move the aircraft through air.	Remember	CO1	CLO 7	AAE007.07
11	Define non air-breathing engine	Engine which utilizes is own stored oxidizer for its combustion process is called as non-air-breathing engine	Understand	CO1	CLO 1	AAE007.01
12	What is the function of rotor in compressor?	The function of rotor is to increase the velocity or dynamic pressure of incoming air with minimum loss.	Understand	CO1	CLO 1	AAE007.01
13	What is the function of stator in compressor	The function of stator is to increase the static pressure of incoming by decreasing the flow velocity with minimum loss.	Understand	CO1	CLO 1	AAE007.01
14	What are the factors affecting engine thrust?	The factors affecting engine thrust are nozzle exit flow velocity. Air speed, mass flow rate, altitude and ram effect.	Remember	CO1	CLO 7	AAE007.07
15	Define thrust generation?	Burning of fuel to produce propulsion, by means of effective thrust production	Remember	CO1	CLO 7	AAE007.07
Unit- II						
1	Define isentropic efficiency of diffuser.	It is defined as the ratio of the enthalpy change that occurred between the entrances to exit stagnation pressure to the kinetic energy.	Understand	CO2	CLO 8	AAE007.08
2	What is inlet or diffuser?	It is a component fixed in front of compressor, whose function is to decelerate the incoming flow to low speed with minimum loss and supply to the compressor.	Remember	CO2	CLO 9	AAE007.09
3	Define adverse pressure gradient.	The increase of static pressure in the flow direction is known as adverse pressure gradient.	Remember	CO2	CLO 9	AAE007.09
4	Define ram effect.	The compressing effect obtained by locating the entrance to an air-intake duct in an airplane in the air stream in such a manner as to take advantage of the relative velocity between the air intake	Remember	CO2	CLO 10	AAE007.10
5	Define buzz.	Low frequency high amplitude disturbance formed at the supersonic intake due shock boundary layer interaction is called buzz.	Remember	CO2	CLO 10	AAE007.10
6	Define stoichiometric ratio.	The stoichiometric ratio is the exact ratio between air and flammable gas or vapor at which	Understand	CO2	CLO 11	AAE007.11

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		complete combustion takes place.				
7	Define equivalence ratio.	The equivalence ratio is defined as the ratio of the actual fuel/air ratio to the stoichiometric fuel/air ratio	Remember	CO2	CLO 12	AAE007.12
8	Define combustion efficiency.	The ratio of heat actually developed in a combustion process to the heat that would be released if the combustion were perfect	Remember	CO2	CLO 12	AAE007.12
9	Define combustion intensity.	It is the ratio of heat release to the product of combustion chamber volume and pressure.	Remember	CO2	CLO 12	AAE007.12
10	Define combustion instability.	Combustion instabilities are physical phenomena occurring in a reacting flow (e.g., a flame) in which some perturbations, even very small ones, grow and then become large enough to alter the features of the flow in some particular way	Remember	CO2	CLO 12	AAE007.12
11	Define combustion stability.	The ability of the combustion process to sustain itself in a continuous manner is called combustion stability.	Remember	CO2	CLO 12	AAE007.12
12	Define additive drag.	The positive drag acting on the stream-tube which encloses the air entering the engine intake isknown as additive drag.	Remember	CO2	CLO 9	AAE007.09
13	Define spillage drag.	It is a drag that occurs when an inlet spills air around the outside of intake instead of conducting the air to the compressor face.	Remember	CO2	CLO 9	AAE007.09
14	What is flame holder?	Flame holder is a component of jet engine combustion chamber which helps in maintaining continual combustion by increasing the residential time of fuel air mixture	Remember	CO2	CLO 12	AAE007.12
15	What is the function of swirl vane on combustion chamber?	The swirl vanes function to provide two effects imperative to proper flame propagation: High flame speed—better mixing of air and fuel, ensuring spontaneous burning.Low air velocity axially—swirling eliminates overly rapid flame movement axially.	Remember	CO2	CLO 12	AAE007.12
Unit- III						
1	Define nozzle choking.	Fluid flow through a restricted area whose mass flow rate reaches a maximum when the fluid velocity reaches the sonic velocity at some point along the flow path ischoking	Remember	CO3	CLO 13	AAE007.13
2	Define favorable pressure gradient.	The decrease of static pressure in the flow direction is known as favorable pressure gradient.	Understand	CO3	CLO 13	AAE007.13

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3	Define thrust reversal	Deflecting the exhaust stream to produce a component of reverse thrust in the direction opposite to the flight direction to use as braking is called thrust reversal	Remember	CO3	CLO 13	AAE007.13
4	Define characteristics Mach number.	Characteristic Mach number is the Mach number attained by the fluid when the throat section is hypothetically brought to sonic conditions.	Remember	CO3	CLO 13	AAE007.13
5	Define nozzle	A passage across which flow gets accelerated is called nozzle.	Understand	CO3	CLO 14	AAE007.14
6	What is under expanded condition?	The pressure at nozzle exit is more than back pressure, results in formation of expansion wave at the nozzle exit is called under expanded condition.	Remember	CO3	CLO 14	AAE007.14
7	What is over expanded condition?	The pressure at nozzle exit is less than back pressure, results in formation of compression wave at the nozzle exit is called over expanded condition	Remember	CO3	CLO 14	AAE007.14
8	What is correctly expanded condition?	The pressure at nozzle exit is equal to the back pressure, results in formation of Mach wave at the nozzle exit is called correctly expanded condition	Remember	CO3	CLO 14	AAE007.14
9	What is the need for variable area nozzle?	Variable area nozzles or adjustable nozzles are required to operate the engine at correctly expanded condition under all operating conditions.	Remember	CO3	CLO14	AAE007.14
10	Define thrust vectoring?	Directing the thrust in a direction other than that parallel to the vehicles' longitudinal axis to improve the maneuverability of aircraft is known as thrust vectoring.	Understand	CO3	CLO 14	AAE007.14
11	Define over-expansion	Over-expanded nozzle the fluid attains a lower exit pressure than theatmosphere as it has an exit area too large for optimum	Understand	CO3	CLO 14	AAE007.14
12	Define under-expansion	Nozzle discharges the fluid at an exit pressure greater thanthe external pressure because the exit area is too small for an optimum arearatio. Nozzle exit pressure is higher than the local atmosphericpressure.	Understand	CO3	CLO 14	AAE007.14
13	Define effective exhaust velocity	Effective exhaust velocity c is the average equivalent velocity atwhich propellant is ejected from the vehicle	Understand	CO3	CLO 14	AAE007.14
14	What is impulse-to-weight ratio?	Impulse-to-weight ratio of a complete propulsion system is defined as thetotal impulse I_t divided by the initial or propellant-loaded vehicle weight w_0.	Remember	CO3	CLO 13	AAE007.13

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15	Define C* (cee-star)	It is also known as characteristic velocity. Its symbol c*, pronounced "cee-star", is defined as $C^* = (p_1^* A_t / \dot{m})$	Understand	CO3	CLO 14	AAE007.14
Unit IV						
1	What do you understand by isentropic efficiency of a compressor?	Compressors are, to a high degree of approximation, adiabatic. The overall efficiency used to measure a compressor's performance is the isentropic efficiency 'η_c, defined as ideal work of compression for given π_c to actual work of compression for given π_c	Remember	CO4	CLO 15	AAE007.15
2	Define polytropic efficiency of a compressor.	The polytropic efficiency, e_c, is defined as the ratio of ideal work of compression for a differential pressure change to actual work of compression for a differential pressure change.	Remember	CO4	CLO 15	AAE007.15
3	What do you understand by surge in compressor?	A limitation on fan and compressor performance of special concern is the stall or surge line. It is defined as the operating point at which centrifugal compressor peak head capability and minimum flow limits are reached.	Remember	CO4	CLO 16	AAE007.15
4	What is IGV and why is it provided?	Inlet Guide Vanes or IGV is provided upstream of the first rotor, forming an additional row of stator blades to direct the axially approaching flow correctly into the first row of rotor blades to meet the design and off-design requirements	Understand	CO4	CLO 16	AAE007.16
5	Define degree of reaction.	It is the ratio of static enthalpy rise in the rotor to static enthalpy rise in the whole stage.	Remember	CO4	CLO 16	AAE007.16
6	Define hysteresis.	It is an important aspect of compressor characteristics. If the width of the hysteresis loop is large, then it becomes difficult to bring the compressor out of stall regime	Understand	CO4	CLO 17	AAE007.16
7	What do you understand by blow off?	The effect of increased axial velocity towards the rear of the compressor can be alleviated by means of blow off, where air is discharged from the compressor at some intermediate stage to reduce the mass flow through the later stages.	Remember	CO4	CLO 17	AAE007.17
8	Define choking condition.	Choking: It is the condition the compressor, in which, it operates at very high mass flow rate and flow through the compressor can't be further increased as Mach number at some part of the	Remember	CO4	CLO 17	AAE007.17

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		compressor reach to unity i.e. to sonic velocity and the flow is said to be choked.				
9	What is compressor stage?	Single stage compressors are also known as piston compressors. In a single stage compressor, the air is compressed once.	Understand	CO4	CLO 17	AAE007.17
10	Define slip factor.	Under certain circumstances, the angle at which the fluid leaves the impeller may not be the same as the actual blade angle. This is due to a phenomenon known as fluid slip, which finally results in a reduction in V_{w2} the tangential component of fluid velocity at impeller outlet.	Remember	CO4	CLO 17	AAE007.17
11	Define stagnation pressure	Stagnation pressure ratio is defined as the ratio between the average total pressure of the air entering the engine to that of the free stream air,	Remember	CO4	CLO 15	AAE007.15
12	Define efficiency of intake	The efficiency of the intake, defined as theratio between the difference between the static pressure at the engine face and the free streamvalue to the dynamic pressure is plotted versus the ratio between the capture area and the duct entry	Remember	CO4	CLO 16	AAE007.15
13	Define capture area	The capture area (A_c) for supersonic intakes is defined as the area enclosed by the leading edge, or "highlight," of the intake cowl, including the cross-sectional area of the fore-body in that plane.	Understand	CO4	CLO 16	AAE007.16
14	Define full flow	A_∞ / A_c= 1.0 is known as full or critical flow	Remember	CO4	CLO 16	AAE007.16
15	Define pressure ratio	The pressure ratio of compressor (π_c) is defined as $\pi c \equiv P_{03} / P_{01} = (T_{03s} / T_{01})^{\gamma/(\gamma-1)}$	Understand	CO4	CLO 17	AAE007.16
Unit V						
1	Define polytropic efficiency of a turbine.	It is the efficiency of a turbine stage operating between infinitesimal pressure differential Δp. It is used in comparing the performance of two used in comparing the performance of two turbines having the same pressure ratio but operating at different temperature levels	Remember	CO5	CLO 18	AAE007.18
2	What do you understand by profile loss?	It is associated with boundary layer growth over the blade profile (including separation loss under adverse conditions of extreme angles of incidence or high inlet (Mach number).	Remember	CO5	CLO 18	AAE007.18

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3	Define annulus loss.	It is associated with boundary layer growth on the inner and outer walls of the annulus.	Understand	CO5	CLO 18	AAE007.18
4	What do you understand by nacelle?	Nacelle refers to the whole covering of an engine that is outside the plane, typically on the wing.	Remember	CO5	CLO 18	AAE007.18
5	Define ramjet.	The flight Mach number increases beyond Mach 3, the benefits of the turbo compressor begin to decrease and the engine begins to operate essentially as a ramjet.	Remember	CO5	CLO 19	AAE007.19
6	What is ramjet combustor?	Combustors similar to afterburner used in turbojet engines are known as ramjet combustor	Remember	CO5	CLO 19	AAE007.19
7	Define axial flow.	A blade which causes the gases to flow parallel to the shaft's axis of rotation is as an axial flow.	Remember	CO5	CLO 19	AAE007.19
8	Define radial flow.	A blade which causes the gases to flow perpendicular to the shaft's axis of rotation is known as a radial flow.	Understand	CO5	CLO 20	AAE007.20
9	What do you understand by flame?	A flame is the visible, gaseous part of fire. It is caused by a highly exothermic reaction taking place in a thin zone. Very hot flames are hot enough to have ionized gaseous components of sufficiently density to be considered for plasma.	Remember	CO5	CLO 20	AAE007.20
10	Define vortex	A vortex is a region in a gas, in which the flow revolves around an axis line, which may be straight or curved. A moving vortex carries with it some angular and linear momentum, energy, and mass.	Understand	CO5	CLO 20	AAE007.20
11	Define inlet total temperature	The inlet total temperature of the turbine is defined from metallurgical capabilities of the turbine material.	Understand	CO5	CLO 18	AAE007.18
12	Define total pressure	Total pressure is known from the pressure drop in the first combustion chamber.	Remember	CO5	CLO 18	AAE007.18
13	Define free power	Free power turbine is defined as either a ratio to the ambient pressure ($P_{05}/P_a \approx 1.1$) or $P_{05} = P_a + 0.04$ bar.	Remember	CO5	CLO 19	AAE007.19
14	Define micro gas turbine	Micro gas turbines are defined as those generating less than 350 kW power, the same name is extensively used recently as gas turbines whose dimensions are of the order of centimetres.	Remember	CO5	CLO 19	AAE007.19

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15	Define combustion intensity	The combustion intensity (CI) can be defined as CI = (heat release rate) / (combustion volume × pressure). SI Units = kW/(m3atm)	Remember	CO5	CLO 19	AAE007.19

Signature of the Faculty **Signature of HOD**