



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Title	SPACE PROPULSION	
Course Code	AAE012	
Programme	B.Tech	
Semester	VI	AE
Course Type	Core	
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Chief Coordinator	Dr. Praveen Kumar Balguri, Associate Professor	
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COURSE OBJECTIVES:

I	Evaluate various space missions, parameters to be considered for designing trajectories and rocket mission profiles.
II	Classify the different chemical rocket propulsion systems, types of igniters and performance considerations of rockets.
III	Discuss the working principle of solid and liquid propellant rockets and gain basic knowledge of hybrid rocket propulsion.
IV	Illustrate electric propulsion techniques, ion, and nuclear rocket and the performances of different advanced propulsion systems.

COURSE OUTCOMES (COs):

The course should enable the students to:	
CO 1	Evaluate various space missions, parameters to be considered for designing trajectories and rocket mission profiles.
CO 2	Classify the different chemical rocket propulsion systems, types of igniters and performance considerations of rockets.
CO 3	Discuss the working principle of solid propellant rockets, propellant grain designs and combustion.
CO 4	Demonstrate the working principle of liquid propellant rockets, feed systems and gain basic knowledge of hybrid rocket propulsion.
CO 5	Illustrate electric propulsion techniques, ion and nuclear rocket and the performances of different advanced propulsion systems.

UNIT-I

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
1	Define Rocket Spin?	It is the torque produced by the rocket about the center of gravity when the thrust vector is not aligned with the roll axis.	Remember	CO1	CLO 1	AAE012.01
2	Define Perturbation.	Modifications to simple conic section orbits caused by such disturbances as air drag, non-uniformity of the Earth, and gravitational fields of more distant bodies such as the Moon.	Remember	CO1	CLO 1	AAE012.02
3	Define rocket staging?	The processor operation during the flight of a rocket vehicle whereby a full stage or half stage is disengaged from the remaining body and made free to decelerate or be propelled along its own flight path.	Remember	CO1	CLO 1	AAE012.04
4	Define Space?	Above the 100km range altitude where the air gets rarified is known as Space.	Remember	CO1	CLO 1	AAE012.01
5	What if the Earth's axis were tilted 90° to the ecliptic?	In this case, the northern hemisphere is in constant light and the other one in constant darkness, a day will become night and night will become day.	Understand	CO1	CLO 2	AAE012.02
6	Why don't we feel the Sun's gravity pull?	The Sun is indeed more massive, but also much more distant. As a result, its pull on each kilogram or pound at the Earth's distance is only about 0.06% of the Earth's pull near the surface.	Understand	CO1	CLO 1	AAE012.01
7	Define Black Holes.	An object whose gravity is so strong that the escape velocity exceeds the speed of light.	Remember	CO1	CLO 1	AAE012.03
8	Define perigee.	Perigee refers to the closest distance that the satellite can have from the Earth. It can also refer to that point in the satellite's orbit at which the satellites reach the closest distance.	Remember	CO1	CLO 2	AAE012.02
9	What is Atmospheric entry?	Atmospheric entry is the movement of an object from outer space into and through the gases of an atmosphere of a planet, dwarf planet, or natural satellite.	Understand	CO1	CLO 2	AAE012.03
10	What are auxiliary rockets?	The Auxiliary Rockets are a set of cheap boosters that are used to boost your speed.	Understand	CO1	CLO 1	AAE012.05
11	Define focus Distance?	The distance from the true center of the orbit ellipse to the center of the Earth.	Understand	CO1	CLO 2	AAE012.02
12	Define Apogee.	Apogee refers to the furthest distance that the satellite can have from the Earth. It can also refer to that point in the satellite's orbit at which the satellites reach the furthest distance.	Remember	CO1	CLO 2	AAE012.02
13	Define Retrograde.	The perceived clockwise motion of a satellite when its motion in its orbit is viewed from the north of the Earth's equatorial plane. A retrograde orbit is quantitatively expressed by an orbit inclination of greater than 90 degrees.	Remember	CO1	CLO 2	AAE012.02
14	What is a descending node?	The precise point in a satellite's orbit that intersects the equatorial plane of the Earth	Understand	CO1	CLO 2	AAE012.02

		as the satellite moves from the northern to the southern hemisphere (descending).				
15	What is Gravity assist trajectory	A trajectory in which angular momentum is transferred from an orbiting planet to a spacecraft approaching from behind. The result is an increase in the spacecraft's velocity.	Understand	CO1	CLO 3	AAE012.03
16	What is Lander Spacecraft?	Lander spacecraft: A spacecraft designed to reach the surface of a planet or moon and survive long enough to telemeter data back to Earth.	Understand	CO1	CLO 3	AAE012.03
17	Define Liftoff.	The start of a rocket's flight from its launch pad.	Remember	CO1	CLO 3	AAE012.06
18	Define Light time.	The amount of time it takes light or radio signals to travel a certain distance at light speed.	Remember	CO1	CLO 3	AAE012.01
19	Define Meridian	Meridian: Great circle that passes through both the north and south poles, also called the line of longitude.	Remember	CO1	CLO 2	AAE012.02
20	Define the Orbital Period.	The interval between successive passages of a satellite through the same point in its orbit. Often called a period	Remember	CO1	CLO 2	AAE012.02
21	What is a sidereal day?	The duration of one rotation of the earth on its axis, with respect to the vernal equinox. It is measured by successive transits of the vernal equinox over the upper branch of a meridian.	Understand	CO1	CLO 1	AAE012.01

UNIT II

1	Define thermal rocket.	A thermal rocket is a rocket engine that uses a propellant that is externally heated before being passed through a nozzle, as opposed to undergoing a chemical reaction as in a chemical rocket.	Remember	CO2	CLO 4	AAE012.06
2	What is station keeping?	The orbital maneuvers made by thruster burns that are needed to keep a spacecraft in a particular assigned orbit are called orbital station-keeping.	Understand	CO2	CLO 5	AAE012.05
3	What is radiation?	The emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which cause ionization.	Understand	CO2	CLO 6	AAE012.07
4	Why gravity does exist?	According to Isaac Newton's Anybody, just by having mass, is able to attract any other, and that's why Earth (a big mass body) attracts our bodies (or any kind of object having mass) against the floor with a force we call Gravity.	Understand	CO2	CLO 5	AAE012.05
5	Define external ballistics?	Exterior or External ballistics is the part of ballistics that deals with the behavior of a projectile in flight.	Remember	CO2	CLO 4	AAE012.07
6	What is a specific impulse?	Specific impulse is a measure of the efficiency of rocket and jet engines.	Understand	CO2	CLO 6	AAE012.06
7	What is the function of insulation mean?	Material that is used to stop the passage of electricity, heat, or sound from one conductor to another.	Understand	CO2	CLO 5	AAE012.07
8	Define ignition.	The process of starting the combustion of fuel in the cylinders of an internal combustion engine.	Remember	CO2	CLO 5	AAE012.08

9	Define mass ratio.	The mass ratio is a measure of the efficiency of a rocket. It describes how much more massive the vehicle is with propellant than without; that is, the ratio of the rocket's wet mass (vehicle plus contents plus propellant) to its dry mass (vehicle plus contents).	Remember	CO2	CLO 5	AAE012.05
10	Define Jet Propulsion.	The propulsion of a rocket or other craft by means of a reaction engine.	Remember	CO2	CLO 6	AAE012.07
11	Define aneroid.	A thin, disk-shaped box or capsule, usually metallic, partially evacuated of air and sealed, which expands and contracts with changes in atmospheric or gaseous pressure.	Remember	CO2	CLO 6	AAE012.08
12	Define the Rocket engine.	A reaction engine that contains within itself, or carries along with itself, all the substances necessary for its operation or for the consumption or combustion of its fuel, not requiring intake of any outside substance and hence capable of operation in outer space.	Remember	CO2	CLO 5	AAE012.05
13	Define a rocket thrust chamber.	The part of a rocket engine comprised of the combustion chamber and the diverging section of the nozzle.	Remember	CO2	CLO 5	AAE012.05
14	What is a retro rocket?	A rocket fitted on or in a spacecraft, satellite, or the like to produce thrust opposed to forward motion.	Understand	CO2	CLO 6	AAE012.08
15	What is Plug nozzle?	A doughnut-shaped combustion chamber which discharges engine gases against the surface of a short central cone (the plug). Adapted in the form of an LH2 cooled heat shield, it can be used as a combination rocket/ aerodynamic braking device.	Understand	CO2	CLO 5	AAE012.07
16	Define Weightlessness.	A state experienced in a ballistic trajectory (i.e. in orbit or free-fall) when, because the gravitational attraction is opposed by equal and opposite inertial forces, a body experiences no mechanical stress.	Remember	CO2	CLO 5	AAE012.08
17	Define Sounding Rocket.	A rocket that carries aloft equipment for making observations of or from the upper atmosphere.	Remember	CO2	CLO 6	AAE012.08

UNIT-III

1	Define Bipropellants.	Bipropellants refer to a propellant combination consisting of liquid fuel and a liquid, which when mixed, can react chemically to form hot combustion gas.	Remember	CO3	CLO 7	AAE012.08
2	Define Burning Rate.	The Burning Rate is the rate of regression of the burning grain surfaces as propellant is consumed or burnt (inches per second) in a direction normal to the surface.	Remember	CO3	CLO 7	AAE012.08
3	Define the Mixture Ratio.	Mixture Ratio is the ratio of the liquid oxidizer flow rate divided by the liquid fuel flow rate.	Remember	CO3	CLO 8	AAE012.08
4	What is binder?	The Binder is a thin layer of a sticky rubbery material that promotes the adhesion of the grain to the case.	Understand	CO3	CLO 8	AAE012.08
5	What is the Nozzle Area Ratio?	The Nozzle Area Ratio is the nozzle exit area divided by the nozzle throat area.	Understand	CO3	CLO 7	AAE012.07

6	What is the control rocket?	A vernier or other rocket used to control the attitude of, or slightly change the speed of, a spacecraft.	Understand	CO3	CLO 7	AAE012.07
7	What are cryogenic fuels?	A rocket fuel or oxidizer is liquid only at very low temperatures, e.g. liquid hydrogen which has a boiling point of -217.2°C (-423°F).	Understand	CO3	CLO 8	AAE012.11
8	Define Cut-off.	The action of stopping a process abruptly, such as shutting off the flow of propellant to a rocket engine.	Remember	CO3	CLO 9	AAE012.10
9	What are Hypergolic Propellants?	If the fuel and the oxidizer react spontaneously (a chemical reaction occurs when they come in contact with each other), they are called Hypergolic Propellants.	Understand	CO3	CLO 7	AAE012.11
10	What are the principal components of a liquid rocket engine?	A Liquid Propellant Rocket Engine has these principal components: one or two Propellant tanks, one or more thrust chambers, a feed mechanism, piping and control valves, and sometimes servo-valves.	Understand	CO3	CLO 8	AAE012.09
11	What are Internal Insulators?	Internal Insulators are layers on the inside of the case wall made of a material with low thermal conductivity; they protect the case from the hot combustion gases and prevent it from reaching the temperature where the case material loses its strength.	Understand	CO3	CLO 9	AAE012.09
12	What is Nose Shroud?	Nose shroud: A cover on the nose of a rocket or spacecraft which jettisons before insertion into orbit.	Understand	CO3	CLO 8	AAE012.08
13	Define Static firing.	The firing of a rocket on a special test stands to measure thrust, etc.	Remember	CO3	CLO 8	AAE012.08
14	What are External Insulators?	External Insulators are applied to the outside of liquid propellant tanks or solid Propellant motor cases to protect against excessive heat transfer from hot air, when flying through the atmosphere at high speed.	Understand	CO3	CLO 8	AAE012.08
15	What is Regenerative cooling?	Circulation of propellant through a jacket around the combustion chamber in order to cool the chamber wall, the propellant subsequently being injected into the combustion chamber.	Understand	CO3	CLO 7	AAE012.10
16	Define Throttle.	To decrease the supply of propellant to an engine, reducing thrust. Liquid propellant rocket engines can be throttled; solid rocket motors cannot.	Remember	CO3	CLO 8	AAE012.11
17	Define Laminar Flow.	In fluid flow, a smooth flow in which no cross-flow of fluid particles occurs between adjacent streamlines; hence, a flow conceived as made up of layers - commonly distinguished from the turbulent flow.	Remember	CO3	CLO 7	AAE012.06
18	What is a boundary-value problem?	A physical problem completely specified by a differential equation in an unknown, valid in a certain region of space, and certain information (boundary condition) about the unknown, given on the boundaries of that region.	Understand	CO3	CLO 8	AAE012.08
19	Define Burnout Velocity.	The velocity of a rocket, rocket-powered aircraft, or the like at the time the fuel or oxidant or both are depleted. Also called	Remember	CO3	CLO 7	AAE012.06

		burnt velocity.				
20	Define Burst.	A single pulse of radio energy; specifically such a pulse at radar frequencies.	Remember	CO3	CLO 7	AAE012.15
21	Define buzz.	Sustained oscillation of an aerodynamic control surface caused by intermittent flow separation on the surface, or by a motion of shock waves across the surface, or by a combination of flow separation and shock-wave motion on the surface.	Remember	CO3	CLO 9	AAE012.13
22	Define a centrifugal compressor.	A compressor having one or more vaned rotary impellers which accelerate the incoming fluid radially outward into a diffuser, compressing by centrifugal force. Sometimes called a centrifugal-flow compressor.	Remember	CO3	CLO 8	AAE012.13
23	Define choking Mach number.	The Mach number at some reference point in a duct or passage (e.g., at the inlet) at which the flow in the passage becomes choked.	Remember	CO3	CLO 8	AAE012.10
24	What is the bumping phenomenon?	A form of combustion instability in a rocket engine, characterized by a pulsing operation at a fairly low frequency, sometimes defined as occurring between particular frequency limits; the noise made in this kind of combustion. Also called chuffing, bumping.	Understand	CO3	CLO 8	AAE012.10
25	Define combustion efficiency.	The efficiency with which fuel is burned, expressed as the ratio of the actual energy released by the combustion to the potential chemical energy of the fuel.	Remember	CO3	CLO 7	AAE012.13
26	What is cryo pumping?	The process of removing gas from a system by condensing it on a surface maintained at very low temperatures.	Understand	CO3	CLO 8	AAE012.12
27	Define Curtis turbine.	A turbine in which a stationary set of blades is used to change the direction of the fluid flow as the fluid travels between two sets of rotating blades	Remember	CO3	CLO 9	AAE012.12
28	Define the heat of ablation.	A measure of the effective heat capacity of an ablating material, numerically the heating rate input divided by the mass loss rate which results from ablation.	Remember	CO3	CLO 8	AAE012.13
29	Define ignition lag.	The time-lapse occurring between the instance of an igniting action of fuel and the onset of a specified burning reaction. Also called.	Remember	CO3	CLO 8	AAE012.09
30	What is Passive Cooling?	Passive cooling: The use of painting, shading, reflectors and other techniques to cool a spacecraft.	Understand	CO3	CLO 9	AAE012.09
UNIT-IV						
1	Why do rockets use liquid fuel?	The primary performance advantage of liquid propellants is due to the oxidizer. Several practical liquid oxidizers (liquid oxygen, nitrogen tetroxide, and hydrogen peroxide) are available which have better specific impulse than the ammonium perchlorate used in most solid rockets when paired with comparable fuels.	Understand	CO4	CLO 10	AAE012.13

2	What is the explosion turbine?	A turbine rotated by gases from an intermittent combustion process taking place in a constant-volume chamber.	Understand	CO4	CLO 12	AAE012.12
3	Define fire point.	The temperature at which a substance, as lubricating oil, will give off a vapor that will burn continuously after ignition. Compare flashpoint.	Remember	CO4	CLO 13	AAE012.13
4	Define Gauge Pressure.	In engineering literature, a term used to indicate the difference between atmospheric pressure and absolute pressure, as read from a differential manometer.	Remember	CO4	CLO 13	AAE012.13
5	What is Impeller?	A device that imparts motion to a fluid; specifically, in a centrifugal compressor, a rotary disk which, faced on one or both sides with radial vanes, accelerates the incoming fluid outward into a diffuser.	Understand	CO4	CLO 12	AAE012.12
6	Define Instability?	The condition of a body if, when displaced from a state of equilibrium, it continues, or tends to continue, to depart from the original condition. Compare stability.	Remember	CO4	CLO 11	AAE012.11
7	Define the interface.	A common boundary between two parts of a system, whether material or nonmaterial.	Remember	CO4	CLO 13	AAE012.13
8	Define Motion.	The act, process, or instance of change of position. Also called movement, especially when used in connection with problems involving the motion of one craft relative to another.	Remember	CO4	CLO 10	AAE012.06
9	Define Nozzle Efficiency.	The efficiency with which a nozzle converts potential energy into kinetic energy commonly expressed as the ratio of the actual change in kinetic energy to the ideal change at the given pressure ratio.	Remember	CO4	CLO 12	AAE012.12
10	What is transpiration Cooling?	A process by which a body having a porous surface is cooled by the forced flow of coolant fluid through the surface from the interior. Compare film cooling.	Understand	CO4	CLO 10	AAE012.09
11	What is Ullage?	The amount that a container, such as a fuel tank, lacks being full.	Understand	CO4	CLO 9	AAE012.09
13	Define the vehicle control system.	A system, incorporating control surfaces or other devices, which adjusts and maintains the altitude and heading, and sometimes speed, of a vehicle in accordance with signals received from a guidance system.	Remember	CO4	CLO 11	AAE012.11
14	What is Virtual gravity?	The force of gravity on an atmospheric parcel, reduced by centrifugal force due to the motion of the parcel relative to the earth.	Understand	CO4	CLO 12	AAE012.06
15	Define Viscous Fluid.	A fluid whose molecular viscosity is sufficiently large to make the viscous forces a significant part of the total force field in the fluid	Remember	CO4	CLO 13	AAE012.05
16	What is warhead?	Originally the part of a missile carrying the explosive, chemical, or other charge intended to damage the enemy. By extension, the term is sometimes used as synonymous with payload or nose cone.	Understand	CO4	CLO 11	AAE012.11

UNIT-V

1	What are Electromagnetic waves?	A wave propagated through space by simultaneous periodic variation in the electric and magnetic field intensity at right angles to each other and to the direction of propagation.	Understand	CO5	CLO 14	AAE012.14
2	What is Ion Engine?	A rocket engine, the thrust of which is obtained by the electrostatic acceleration of ionized particles.	Understand	CO5	CLO 14	AAE012.14
3	Define Elevation.	The angular measure of the height of an object above the horizon; with azimuth, one of the coordinates defining a celestial location and sometimes used in tracking spacecraft.	Remember	CO5	CLO 14	AAE012.14
	What is Plasma Engine?	A rocket engine in which thrust is obtained from the acceleration of plasma with crossed electrical and magnetic fields.	Understand	CO5	CLO 14	AAE012.14
4	Define Gyration.	The circular motion of ions and electrons around magnetic field lines.	Remember	CO5	CLO 15	AAE012.15
5	What is a High-energy particle detector?	A device for measuring the energy spectra of trapped energetic electrons, and the energy and composition of atomic nuclei.	Understand	CO5	CLO 15	AAE012.15
5	Define the Interplanetary magnetic field.	The weak magnetic field filling interplanetary space, with field lines usually connected to the Sun.	Remember	CO5	CLO 15	AAE012.15
6	Define Isotropic.	A property of a distribution of particles where the flux is constant over all directions.	Remember	CO5	CLO 15	AAE012.15
7	What is a Low-energy charged particle detector?	A device designed to characterize the composition, energies, and angular distributions of charged particles in interplanetary space and within planetary systems.	Understand	CO5	CLO 15	AAE012.15
8	What is a magnetometer?	A device for measuring the strength and direction of the interplanetary and solar magnetic fields.	Understand	CO5	CLO 15	AAE012.15
9	What is plasma Wave Detector?	A device for measuring the electrostatic and electromagnetic components of local plasma waves in three dimensions.	Understand	CO5	CLO 15	AAE012.15
	Define Kirchhoff's law.	The radiation law states that at a given temperature the ratio of the emissivity to the absorptivity for a given wavelength is the same for all bodies and is equal to the emissivity of an ideal black body at that temperature and wavelength.	Remember	CO5	CLO 15	AAE012.15
10	Define Microgravity.	An environment of very weak gravitational forces, such as those within an orbiting spacecraft. Microgravity conditions in space stations may allow experiments or manufacturing processes that are not possible on Earth.	Remember	CO5	CLO 14	AAE012.14
11	What is the Photon Engine?	A projected type of reaction engine in which thrust would be obtained from a stream of electromagnetic radiation.	Understand	CO5	CLO 14	AAE012.15
12	Define Ion.	A charged atom or molecularly bound group of atoms; sometimes also a free electron or other charged subatomic particle.	Remember	CO5	CLO 15	AAE012.15

13	Define Isometric Transition.	A radioactive transition from one nuclear isomer to another of lower energy.	Remember	CO5	CLO 14	AAE012.15
14	What is Ionization?	Formation of electrically charged particles. It can be produced by high-energy radiation such as light or UV rays, or by a collision of particles in thermal agitation.	Understand	CO5	CLO 14	AAE012.15
15	What is mass-energy equivalence?	The equivalence of a quantity of mass m and a quantity of energy E , the two quantities being related by the mass-energy relation, $E = mc^2$.	Understand	CO5	CLO 15	AAE012.15
16	Define the mean free path.	Of any particle, the average distance that a particle travels between successive collisions with the other particles of an ensemble.	Remember	CO5	CLO 14	AAE012.15
17	What is Nuclear Rocket Engine?	A rocket engine in which a nuclear reactor is used as a power source or as a source of thermal energy.	Understand	CO5	CLO 15	AAE012.14
18	Define Sub-atomic Particle.	Any particle of less than atomic mass, e.g., the electron, proton, and neutron, also called atomic particle.	Remember	CO5	CLO 14	AAE012.15
19	What is Vacuum Tube?	An electron tube evacuated to such a degree that its electrical characteristics are essentially unaffected by the presence of residual gas or vapor.	Understand	CO5	CLO 15	AAE012.15
20	What is the zeta machine?	An experimental thermonuclear device which generates a plasma inside a torus and employs the pinch effect for heating and compression.	Understand	CO5	CLO 15	AAE012.15
21	What is charge neutrality?	The approximate equality of positive and negative particles in high-density plasmas.	Understand	CO5	CLO 15	AAE012.15

Signature of the Faculty

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