



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## AERONAUTICAL ENGINEERING

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	FLUID DYNAMICS
Course Code	:	AAEB03
Program	:	B.Tech
Semester	:	III
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Section	:	A&B
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Course Faculty	:	Dr. Govardhan D, Professor and Head of the Department, AE Mr. Shiva Prasad U, Assistant Professor, AE

#### 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
<b>MODULE-I</b>						
1	Define Fluid Mechanics?	The branch of applied mechanics dealing with the behavior of fluids at rest and in motion.	Remember	CO 1	CLO 1	AAEB03.01
2	Define Specific gravity.	Specific gravity is the ratio of the density of a substance to the density of a reference substance; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance for the same given volume.	Remember	CO 1	CLO 1	AAEB03.01
3	Define Density?	The density, or more precisely, the volumetric mass density, of a substance is its mass per unit volume.	Remember	CO 1	CLO 1	AAEB03.01
4	Define Pressure?	Pressure is an expression of force exerted on a surface per unit area.	Remember	CO 1	CLO 1	AAEB03.01
5	State Pascal's law?	Pascal's law states that the pressure of a gas or liquid exerts force equally in all directions against the walls of its container.	Understand	CO 1	CLO 1	AAEB03.01
6	What is meant by stagnation pressure?	In fluid dynamics, stagnation pressure (or pitot pressure) is the static pressure at a stagnation point in a fluid flow.	Understand	CO 1	CLO 1	AAEB03.01
7	Define compressibility of a fluid.	If application of pressure changes volume or density of the fluid then fluid is said to be compressible.	Remember	CO 1	CLO 2	AAEB03.02
8	Define viscosity of a fluid.	The viscosity of a fluid is a measure of its resistance to deformation at a given rate.	Remember	CO 1	CLO 2	AAEB03.02

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
9	State the Newton's law of viscosity.	Newton's viscosity law's states that, the shear stress between adjacent fluid layers is proportional to the velocity gradients between the two layers.	Understand	CO 1	CLO 2	AAEB03.02
10	What is the effect of temperature on viscosity?	The former effect causes a decrease in the shear stress while the latter causes it to increase. The result is that liquids show a reduction in viscosity with increasing temperature.	Understand	CO 1	CLO 2	AAEB03.02
11	Define ideal fluid.	Ideal fluid do not actually exist in nature, but sometimes used for fluid flow problems.	Remember	CO 1	CLO 2	AAEB03.02
12	Define real fluid.	Fluid that have viscosity( $\mu > 0$ ) and their motion known as viscous flow	Remember	CO 1	CLO 2	AAEB03.02
13	Define capillarity.	The tendency of a liquid in a capillary tube or absorbent material to rise or fall as a result of surface tension.	Remember	CO 1	CLO 2	AAEB03.02
14	Define Specific Weight.	The specific weight (also known as the unit weight) is the weight per unit volume of a material.	Understand	CO 1	CLO 3	AAEB03.03
15	What is Specific Volume?	Specific volume of a substance is the ratio of the substance's volume to its mass.	Understand	CO 1	CLO 3	AAEB03.03
16	Define kinematic viscosity.	The kinematic viscosity is the ratio between the dynamic viscosity and the density of a fluid.	Remember	CO 1	CLO 3	AAEB03.03
17	What is manometer?	The term "manometer" usually means a U-shaped tube partly filled with fluid, that measures air pressure.	Remember	CO 1	CLO 3	AAEB03.03
18	Define center of pressure.	The center of pressure is the point where the total sum of a pressure field acts on a body, causing a force to act through that point.	Remember	CO 1	CLO 3	AAEB03.03
19	State Archimedes' principle.	Archimedes' principle states that the upward buoyant force that is exerted on a body immersed in a fluid, whether fully or partially submerged, is equal to the weight of the fluid that the body displaces and acts in the upward direction at the center of mass of the displaced fluid.	Understand	CO 1	CLO 3	AAEB03.03
20	Define metacenter.	The point of intersection of the vertical through the center of buoyancy of a floating body with the vertical through the new center of buoyancy when the body is displaced.	Remember	CO 1	CLO 3	AAEB03.03
21	Define Stability?	Ability of a substance to remain unchanged over time under stated or reasonably expected conditions of storage and use.	Remember	CO 1	CLO 3	AAEB03.03
<b>MODULE 2</b>						
1	Define Similarity.	Similarity in appearance or character or nature between persons or things.	Remember	CO 2	CLO 4	AAEB03.04
2	State Buckingham Pi Theorem.	Buckingham $\pi$ theorem states that an equation involving n number of physical variables which are expressible in terms of k independent fundamental physical quantities can be expressed in terms of $p = n - k$ dimensionless parameters.	Understand	CO 2	CLO 4	AAEB03.04
3	Define Reynolds Number?	Reynolds's number is defined by the ratio of inertial forces to that of viscous forces.	Remember	CO 2	CLO 4	AAEB03.04

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
4	Define Froude number.	The Froude Number is a dimensionless parameter measuring the ratio of "the inertia force on a element of fluid to the weight of the fluid element" - the inertial force divided by gravitational force.	Remember	CO 2	CLO 4	AAEB03.04
5	Define geometric similarity?	Two geometrical objects are called similar if they both have the same shape, or one has the same shape as the mirror image of the other.	Remember	CO 2	CLO 4	AAEB03.04
6	What is Kinematic similarity?	Fluid flow of both the model and real application must undergo similar time rates of change motions.	Understand	CO 2	CLO 4	AAEB03.04
7	What is Dynamic similarity?	It is a ratio of all forces acting on corresponding fluid particles and boundary surfaces in the two systems are constant.	Understand	CO 2	CLO 4	AAEB03.04
8	What is laminar flow?	Laminar flow is a flow regime characterized by high momentum diffusion and low momentum convection.	Understand	CO 2	CLO 5	AAEB03.05
9	Define In-viscid Fluid Flows.	The fluid flow in which frictional effects become signification, are treated as viscous flow.	Remember	CO 2	CLO 5	AAEB03.05
10	Define Steady fluid flow.	A flow that is not a function of time is called steady flow.	Remember	CO 2	CLO 5	AAEB03.05
11	Define vorticity.	Vector quantity that is proportional to the angular momentum of a fluid element. OR The state of a fluid in vortical motion	Remember	CO 2	CLO 5	AAEB03.05
12	Define rotational fluid flow.	In which the fluid particles while flowing along stream lines, Also rotate about their own axis.	Remember	CO 2	CLO 5	AAEB03.05
13	Define coquette flow.	Couette flow is the flow of a viscous fluid in the space between two surfaces, one of which is moving tangentially relative to the other.	Remember	CO 2	CLO 5	AAEB03.05
14	What is continuity equation?	The continuity equation states that the rate at which mass enters a system is equal to the rate at which mass leaves the system plus the accumulation of mass within the system.	Understand	CO 2	CLO 6	AAEB03.06
15	Define momentum.	Momentum is mass in motion and only applies to objects in motion.	Remember	CO 2	CLO 7	AAEB03.07
16	What is vapor pressure?	Vapour pressure of a pure compound is the pressure characteristic at any given temperature of a vapour in equilibrium with its liquid or solid form.	Understand	CO 2	CLO 6	AAEB03.06
17	Define Scale effect.	The correction necessary to apply to measurements made on a model in a wind tunnel in order to deduce corresponding values for the full-sized object.	Remember	CO 2	CLO 6	AAEB03.06
18	Define velocity gradient.	The velocity gradient $L$ is defined as the gradient of the spatial description of the velocity.	Remember	CO 2	CLO 6	AAEB03.06
19	Define Two dimensional flows.	Fluid motion can be said to be a two-dimensional flow when the flow velocity at every point is parallel to a fixed plane.	Remember	CO 2	CLO 6	AAEB03.06
20	Define poiseuille flow?	Poiseuille flow is pressure-induced flow (Channel Flow) in a long duct, usually a	Remember	CO 2	CLO 6	AAEB03.06

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		pipe.				
<b>MODULE-3</b>						
1	What is fluid motion physics?	The density of the fluid remains the same throughout the fluid (non-compressibility).	Understand	CO 3	CLO 7	AAEB03.07
2	What Is Fluid Dynamics?	The flow of gas has many similarities to the flow of liquid, but it also has some important differences.	Understand	CO 3	CLO 7	AAEB03.07
3	Why can fluids flow?	This means that liquid particles are further apart and can move about more easily.		CO 3	CLO 7	AAEB03.07
4	Define Strain rate.	Strain rate is the change in strain (deformation) of a material with respect to time.	Remember	CO 3	CLO 7	AAEB03.07
5	What is Rate of strain?	"Rate of strain" refers to the rate at which parts of a fluid are being separated.	Understand	CO 3	CLO 7	AAEB03.07
6	Define the Rate of Dilatation?	The rate of dilatation can be thought of as the rate of expansion, per unit volume, that a fluid element is experiencing.	Remember	CO 3	CLO 7	AAEB03.07
7	Define Stream line.	A streamline is a path traced out by a massless particle as it moves with the flow.	Remember	CO 3	CLO 7	AAEB03.07
8	What does Bernoulli's equation mean?	The Bernoulli Equation can be considered to be a statement of the conservation of energy principle appropriate for flowing fluids.	Understand	CO 3	CLO 8	AAEB03.08
9	What is Bernoulli's equation formula?	Pressure + $\frac{1}{2}$ density * square of the velocity + density * gravity. Acceleration* height = constant.	Understand	CO 3	CLO 8	AAEB03.08
10	Why is Bernoulli's principle important?	Bernoulli's Principle is the single principle that helps explain how heavier-than-air objects can fly.	Understand	CO 3	CLO 8	AAEB03.08
11	Why is the pressure low when velocity is high in fluids?	It is because the higher pressure region accelerated (increased speed of) the fluid toward the lower pressure region.	Understand	CO 3	CLO 8	AAEB03.08
12	What is the constant in Bernoulli's equation?	The specific internal energy is constant in Bernoulli's equation as the flow is incompressible.	Understand	CO 3	CLO 8	AAEB03.08
13	Why is head loss important?	A portion of that energy is lost to the resistance to flow. This resistance to flow is called head loss due to friction.	Understand	CO 3	CLO 8	AAEB03.08
14	What Is the Venturi Effect?	The Venturi effect is the reduction in fluid pressure that results when a fluid flows through a constricted section (or choke) of a pipe.	Understand	CO 3	CLO 8	AAEB03.08
15	What happens in a Venturi?	This "channeling" effect is just one form of a larger fluid flow principle — the Venturi effect.	Understand	CO 3	CLO 8	AAEB03.08
16	What is a Venturi used for?	Venturi are used to measure the speed of a fluid, by measuring the pressure changes from one point to another along the venture.	Understand	CO 3	CLO 8	AAEB03.08
17	How can pressure be measured?	The standard SI unit for pressure measurement is the Pascal (Pa) which is equivalent to one Newton per square meter (N/m <sup>2</sup> ) or the Kilo Pascal (kPa) where 1 kPa = 1000 Pa.	Understand	CO 3	CLO 9	AAEB03.09
18	What are the types of pressure measurement?	The pressure measurement can be classified as: gauge, absolute and differential or relative.	Understand	CO 3	CLO 9	AAEB03.09



S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
19	How are sensors classified for pressure measurement?	Sensors are classified according to the technique used on the mechanical pressure over a proportional electronic signal	Understand	CO 3	CLO 9	AAEB03.09
20	Define mass flow rate?	Mass flow rate is the mass of a substance which passes per unit of time.	Remember	CO 3	CLO 9	AAEB03.09
21	How do you find average mass flow rate?	The fluid amount can be measured by either volume or mass.	Understand	CO 3	CLO 9	AAEB03.09
22	How do you calculate area of flow?	If the liquid is flowing through a pipe, the area is $A = \pi r^2$ , where r is the radius of the pipe.	Understand	CO 3	CLO 9	AAEB03.09
23	What is a Pitot Tube?	The pitot tube is used to measure the velocity of flow of air or any fluid.	Understand	CO 3	CLO 9	AAEB03.09
24	What is the difference between pitot tube and pitot static tube?	The difference between these two is the dynamic pressure. That static port might be on the side of the fuselage, for example.	Understand	CO 3	CLO 9	AAEB03.09
25	How do you calculate pressure in a pitot tube?	Pitot tubes can be used to measure fluid flow velocity by measuring static and dynamic pressure difference	Understand	CO 3	CLO 9	AAEB03.09

#### MODULE-4

1	Define boundary layer.	A boundary layer is an important concept and refers to the layer of fluid in the immediate vicinity of a bounding surface where the effects of viscosity are significant.	Remember	CO 4	CLO 10	AAEB03.10
2	What is the boundary layer theory?	Theory which deals with fluid and thermal boundary layer thickness over the boundary.	Understand	CO 4	CLO 10	AAEB03.10
3	Define thermal boundary layer thickness.	The thermal boundary layer thickness is similarly the distance from the body at which the temperature is 99% of the free stream temperature.	Understand	CO 4	CLO 10	AAEB03.10
4	Define Surface layer.	The surface layer is the layer of a turbulent fluid most affected by interaction with a solid surface or the surface separating a gas and a liquid where the characteristics of the turbulence depend on distance from the interface.	Remember	CO 4	CLO 10	AAEB03.10
5	What is mean by boundary layer growth?	At subsequent points downstream of the leading edge, the boundary layer region increases because the retarded fluid is further retarded. This is referred as growth of boundary layer.	Understand	CO 4	CLO 10	AAEB03.10
6	Define Laminar boundary layer.	Near the leading edge of the surface of the plate the thickness of boundary layer is small and flow is laminar. This layer of fluid is said to be laminar boundary layer.	Remember	CO 4	CLO 10	AAEB03.10
7	Define transition zone.	After laminar zone, the laminar boundary layer becomes unstable and the fluid motion transformed to turbulent boundary layer. This short length over which the changes taking place is called as transition zone.	Remember	CO 4	CLO 10	AAEB03.10
8	Define Turbulent boundary.	Further downstream of transition zone, the boundary layer is turbulent and continuous	Remember	CO 4	CLO 10	AAEB03.10

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		to grow in thickness. This layer of boundary is called turbulent boundary layer.				
9	Define Laminar sub Layer	In the turbulent boundary layer zone, adjacent to the solid surface of the plate the velocity variation is influenced by viscous effects. Due to very small thickness, the velocity distribution is almost linear. This region is known as laminar sub layer.	Remember	CO 4	CLO 10	AAEB03.10
10	What is the boundary condition for the velocity profile adjacent to it?	The boundary condition at the surface of the boundary is zero, zero velocity and it varies in parabolic manner.	Understand	CO 4	CLO 10	AAEB03.10
11	Define Lift.	The component of the total force in the direction perpendicular to the direction of motion is known as lift.	Remember	CO 4	CLO 11	AAEB03.11
12	Define Drag Force.	The drag force on elemental area = Force due to pressure in the direction of fluid motion + Force due to shear stress in the direction of fluid motion.	Remember	CO 4	CLO 11	AAEB03.11
13	Define Lift Force.	The lift force on elemental area = Force due to pressure in the direction perpendicular to the direction of motion + force due to shear stress in the direction perpendicular to the direction of motion.	Remember	CO 4	CLO 11	AAEB03.11
14	Define Magnus effect.	In a cylinder is rotated in a uniform flow a lift force is produced on the cylinder. This phenomenon of the lift force produced by a rotating cylinder in a uniform flow is known as Magnus effect.	Remember	CO 4	CLO 11	AAEB03.11
15	Define steady state of airplane?	Weight of plane = Lift force Thrust by engine = Drag force	Understand	CO 4	CLO 11	AAEB03.11
16	Define Lift.	The component of the total force in the direction perpendicular to the direction of motion is known as lift.	Remember	CO 4	CLO 11	AAEB03.11
17	What are the types of BL thickness?	Displacement thickness, Momentum thickness, Energy thickness.	Understand	CO 4	CLO 12	AAEB03.12
18	Define momentum thickness.	The momentum thickness is defined as the distance by which the boundary should be displaced to compensate for the reduction in momentum of the flowing fluid on account of boundary layer formation.	Remember	CO 4	CLO 12	AAEB03.12
19	Define energy thickness.	The energy thickness is defined as the distance by which the boundary should be displaced to compensate for the reduction in kinetic energy of the flowing fluid on account of boundary layer formation.	Remember	CO 4	CLO 12	AAEB03.12
20	Define drag.	The component of the total force in the direction of motion is called drag.	Remember	CO 4	CLO 12	AAEB03.12
<b>MODULE-5</b>						
1	What are fluid machines?	The machines which use the liquid or gas for the transfer of energy from fluid to rotor or from rotor to fluid are known as fluid machines.	Understand	CO 5	CLO 13	AAEB03.13
2	How are fluid machines classified?	Fluid machines are classified into two categories depending upon transfer of energy: 1. Turbines & hydraulic energy is	Understand	CO 5	CLO 13	AAEB03.13

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		converted to mechanical energy and then electrical energy. 2. Pumps & electrical energy is converted to mechanical energy and then hydraulic energy.				
3	Define hydraulic turbines?	Hydraulic turbines are the machines which use the energy of water and convert it into mechanical energy.	Remember	CO 5	CLO 13	AAEB03.13
4	Write Euler's equation for turbo machines?	The general expression for the work done per second on impeller is $\rho Q[Vw_1u_1 + Vw_2u_2]$	Understand	CO 5	CLO 13	AAEB03.13
5	Define an impulse turbine.	If at the inlet of the turbine, the energy available is only kinetic energy, the turbine is known as impulse turbine.	Remember	CO 5	CLO 13	AAEB03.13
6	Define reaction turbine.	If at the inlet of the turbine, the water possesses kinetic energy as well as pressure energy, the turbine is known as reaction turbine.	Remember	CO 5	CLO 14	AAEB03.14
7	Define Jet Ratio.	It is defined as the ratio of the pitch diameter of the pelton wheel to the diameter of the jet.	Remember	CO 5	CLO 14	AAEB03.14
8	Define a Specific speed.	A factor by which the performance of any particular design of impeller for a centrifugal pump or water turbine can be computed.	Remember	CO 5	CLO 14	AAEB03.14
9	What is slip factor?	The slip factor is a measure of the fluid slip in the impeller of a compressor or a turbine, mostly a centrifugal machine.	Understand	CO 5	CLO 14	AAEB03.14
10	Define turbine.	A machine for producing continuous power in which a wheel or rotor, typically fitted with vanes, is made to revolve by a fast-moving flow of water, steam, gas, air, or other fluid.	Remember	CO 5	CLO 14	AAEB03.14
11	Define Compressor.	A compressor is a mechanical device that increases the pressure of a gas by reducing its volume.	Remember	CO 5	CLO 14	AAEB03.14
12	Classify the types of pumps.	Two basic types classify pumps: positive displacement pumps and centrifugal pumps.	Remember	CO 5	CLO 15	AAEB03.15
13	Define Axial flow compressor	An axial-flow compressor is one in which the flow enters the compressor in an axial direction (parallel with the axis of rotation) and exits from the gas turbine also in an axial direction.	Remember	CO 5	CLO 15	AAEB03.15
14	Define Centrifugal flow compressor	This compressor is used to transfer energy using the impeller blades that rotate to create a centrifugal force.	Remember	CO 5	CLO 15	AAEB03.15
15	Define Pump	A device that raises, transfers, delivers, or compresses fluids or that attenuates gases especially by suction or pressure or both.	Remember	CO 5	CLO 15	AAEB03.15
16	Define Degree of reaction.	Degree of reaction is a ratio of change of pressure energy inside turbine to the change of total energy inside turbine.	Remember	CO 5	CLO 15	AAEB03.15
17	What is a reaction turbine?	A reaction turbine is a type of turbine that develops torque by reacting to the pressure or weight of a fluid.	Understand	CO 5	CLO 15	AAEB03.15
18	Define fan.	An apparatus with rotating blades that creates a current of air for cooling or ventilation. A fan moves large amounts of gas with low increase in pressure.	Remember	CO 5	CLO 15	AAEB03.15

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19	Name the type of blowers	Positive Displacement, Helical Screw Blowers, Centrifugal Blowers, High Speed Blowers, Regenerative Blowers.	Remember	CO 5	CLO 15	AAEB03.15
20	Define compressor?	A compressor is a machine for raising gas to a higher level of pressure, actually making the air denser by cramming air into a small space.	Remember	CO 5	CLO 15	AAEB03.15

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