INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**THERMODYNAMICS**
Course Code	:	**AMEB04**
Program	:	**B. Tech.**
Semester	:	**THREE**
Branch	:	**Mechanical Engineering**
Academic Year	:	**2020 – 2021**
Course Faculty	:	**Ms. N Santhi Sree, Assistant Professor**

COURSE OBJECTIVES:

I	The fundamental knowledge on concepts of physics and chemistry for obtaining the axiomatic principles using thermodynamic co-ordinates.
II	The thermodynamic disorderness in the real time physical systems like external/internal heat engines, heat pumps to get the measure of performance characteristics.
III	The performance characteristics of open and closed systems of thermodynamic cycles for effective delineation of real time applications.
IV	The thermodynamic cycles such as power and refrigerant cycles to yield alternative solutions to conserve the environment.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

UNIT - I				
S.No	**QUESTION**	**ANSWER**	**Blooms Level**	**Course Outcomes**
1	What Thermodynamics?	Thermodynamics is a branch of science which deals with the energy changes accompanying physical and chemical transformations. It is not concerned with the total energy of a body, but with energy changes accompanying a given process or transformation. Thermodynamics is concerned in nature.	Understand	CO 1
2	Define System?	A portion of universe which is under investigation, e.g., portion of test tube where reaction is taking place, is called system	Understand	CO 1
3	Define surroundings?	The rest of the universe which might be in a position to exchange energy and matter with the system is called the surroundings.	Remember	CO 1
4	What is boundary?	The system is separated from the surroundings by a boundary which may be real or imaginary.	Understand	CO 1

5	What is homogeneous system?	A system is said to be homogeneous when it is completely uniform throughout, for example, a pure solid or liquid or a solution or a mixture of gases. In other words, a homogeneous system consists of only one phase.	Understand	CO 1
6	Define Isolated system?	Isolated system is one that can transfer neither matter nor energy to and from, its surroundings.	Remember	CO 1
7	Define closed system?	The boundary is sealed but not insulated. Therefore, A closed system is one which cannot transfer matter but can transfer energy in the form of heat, work and radiation to and from its surroundings	Understand	CO 1
8	Define open system?	An open system is one which can transfer both energy and matter to and from its surroundings.	Remember	CO 1
9	What is macroscopic System?	A system is said to be macroscopic when it consists of a large number of molecules, atoms or ions.	Remember	CO 1
10	What are macroscopic properties?	The properties associated with a macroscopic system are called macroscopic properties. These properties are pressure, volume, temperature, etc.	Remember	CO 1
11	What is PMM1?	Perpetual-Motion Machine of the First Kind (PMM1) - A perpetual-motion machine of the first kind is a device that violates the first law of thermodynamics (by creating energy).	Remember	CO 4
12	What is state extensive property?	An extensive property of a system is that which depends upon the amount of the substance or substances present in the system. The examples are mass, volume, energy, heat capacity, enthalpy, entropy, free change etc.	Remember	CO 1
13	Define Isolated system?	Isolated system is one that can transfer neither matter nor energy to and from, its surroundings.	Understand	CO 1
14	What intensive property?	An intensive property of a system is that which is independent of the amount of the substance present in the system. The examples are temperature, pressure, density, viscosity, refractive index, surface tension and specific heat.	Understand	CO 1
15	Define Mechanical equilibrium?	A system is said to be-in mechanical equilibrium if no mechanical work is done by one part of the system on another part of the system. This is possible if the pressure remains the same throughout in all parts of the system.	Understand	CO 1
16	Define Chemical equilibrium?	A system is said to be in chemical equilibrium if the composition of the various phases in the system remains the same throughout.	Understand	CO 1
17	What is a process?	It Whenever the state of a system changes, it is said to have undergone a process. Thus a process may be defined as the operation by which a system changes from one state to another.	Understand	CO 1
18	What is a Isothermal process?	T remains constant. It is the process in which the temperature of the system remains constant during each step. In such a process the systems are in thermal contact with a constant temperature and both exchange heat with surroundings i.e. both maintain this temperature ($\Delta T = 0$).	Understand	CO 1
19	What is a Adiabatic process? (Thermally	A process in which no heat is exchanged between the system and surroundings is called adiabatic	Understand	CO 1

	insulated from the surroundings)	process (Q = O). System in which such processes occur are thermally insulated from the surroundings.		
20	What is a Zeroth law of thermodynamics?	Zeroth law of thermodynamics states that if system A is in thermal equilibrium with system B, and system B is in thermal equilibrium with system C, then system C is also in thermal equilibrium with system A (TA = TB = TC).	Remember	CO 1
UNIT - II				
1	What is Reversible Processes?	A thermodynamic reversible process is one that takes place infinitesimally slowly and its direction at any point can be reversed by an infinitesimally change in the state of the system.	Understand	CO 1
2	What is Irreversible Processes?	When a process goes from the initial state to the final state in a single step and cannot be carried in the reverse order, it is to be an irreversible process.	Remember	CO 1
3	What is a Second law of thermodynamics?	Second law of thermodynamics states that in isolated systems the entropy increases in spontaneous processes, i.e., $\Delta S > 0$; in reversible process at equilibrium it is constant, i.e., $\Delta S = 0$. or It is impossible to convert heat completely into work. or Heat cannot spontaneously flow from a material at lower temperature to a material at higher temperature.	Understand	CO 1
4	Define enthalpy?	Enthalpy (H) $H=U+pV$, where U is the internal energy, p pressure and V volume. Its change gives the heat at constant pressure when there is no other work.	Understand	CO 1
5	What is isentropic process	The reversible adiabatic process is isentropic process or The process where entropy remains constant.	Understand	CO 2
6	Define entropy?	Entropy (S, J/K) is a thermodynamic quantity that expresses the degree of disorder or randomness in a system at the molecular level $dS=\delta Qrev/T$.	Understand	CO 2
7	Define Availability?	Availability - The maximum useful work that can be obtained from a system at a given state in a specified environment.	Understand	CO 2
8	Define Carnot Cycle?	Carnot Cycle - The Carnot cycle is composed of four reversible processes. Two of the processes are isothermal and two are adiabatic.	Understand	CO 2
9	Define Carnot Heat Engine?	Carnot Heat Engine - A Carnot heat engine is a hypothetical heat engine that operates on the Carnot cycle.	Remember	CO 2
10	Define Carnot Principles?	Carnot Principles - (1) The efficiency of an irreversible heat engine is always less than the efficiency of a reversible one operating between the same two reservoirs.	Understand	CO 2
11	Define PMM2?	Perpetual-Motion Machine of the Second Kind (PMM2) - A perpetual-motion machine of the second kind is a device that violates the second law of thermodynamics.	Understand	CO 4
12	What is Coefficient of Performance of a Heat Pump?	Coefficient of Performance of a Heat Pump - A measure of the efficiency of a heat pump. The coefficient of performance of a heat pump is	Remember	CO 4

		defined as the fraction of the desired output over the required input of the heat pump.		
13	What is COP of a Refrigerator?	Coefficient of Performance of a Refrigerator - Coefficient of performance of refrigerator is the efficiency of a refrigerator and is defined as the fraction of the desired output over the required input of the refrigerator.	Remember	CO 3
14	What is Dead State?	Dead State - A state that is in thermodynamic equilibrium with its surroundings.	Remember	CO 4
15	Define Entropy	Entropy - A measure of molecular disorder.	Understand	CO 4
16	What is Entropy Generation?	Entropy Generation - A measure of the irreversibility's or imperfections which occur during a cycle.	Understand	CO 4
17	Define Claussius Statement?	Claussius Statement - States that it is impossible to construct a device that operates in cycle and produces no effect other than the transfer of heat from a lower temperature body to a higher temperature body.	Remember	CO 2
18	What is Flow Work?	Flow Work (or Flow Energy) - The work required to push mass into or out of the control volume. Flow work is necessary for maintaining a continuous flow through a control volume.	Remember	CO 4
19	Define Heat Reservoir?	Heat Reservoir - A heat reservoir is a thermal energy reservoir that supplies or absorbs energy in the form of heat. Both sources and sinks are heat reservoirs.	Remember	CO 4
20	Define Kelvin Scale?	Kelvin Scale - An absolute thermodynamic temperature proposed by Lord Kelvin. In a reversible process, the ratio of the heat associated with the high temperature to the heat associated with the low temperature is equal to the ratio of the high temperature over the low temperature.	Remember	CO 4
UNIT – III				
1	Define ideal gas	Gas having no forces of intermolecular attraction	Remember	CO 7
2	What is ideal gas law?	Ideal gas obeys the law pv = RT	Understand	CO 7
3	What is Boyle's law?	It states that volume of a given mass of a perfect gas varies inversely as the absolute pressure when temperature is constant.	Remember	CO 7
4	What is Charle's law?	It states that if any gas is heated at constant pressure, its volume changes directly as its absolute temperature.	Understand	CO 7
5	Define p-V-T surface	The equation of state of an ideal gas is a relationship between the variables pressure (p), volume (V) and temperature (T). On plotting these variables along three mutually perpendiculars axes, we get a surface which represents the equation of state (pv = RT). Such a surface is called p-v-T surface.	Remember	CO 7
6	State Joule's law.	Joule's law states that the specific internal energy of a gas depends only on the temperature of the gas and is independent of both pressure and volume	Understand	CO 7

7	Define reduced properties.	The ratios of pressure, temperature and specific volume of a real gas to the corresponding critical values are called the **reduced properties**.	Remember	CO 7
8	State law of corresponding states?	If any two gases have equal values of reduced pressure and reduced temperature, then they have same values of reduced volume	Understand	CO 7
9	Define equation of state.	The relation between the independent properties, such as pressure, specific volume and temperature for a pure substance is known as 'equation of state'.	Understand	CO 7
10	Write vanderwall's equation	$\left(p+\frac{a}{v^2}\right)(v-b)=RT$	Remember	CO 7
11	Define pure substance	A pure substance is defined as a substance having a constant and uniform chemical composition	Understand	CO 7
12	What is heat of vaporization.	The amount of heat required to convert the liquid water completely into vapour under this condition is called the *heat of vapourisation*.	Remember	CO 7
13	Define saturation pressure and temperature	The temperature at which vaporisation takes place at a given pressure is called the *saturation temperature* and the given pressure is called the *saturation pressure*.	Understand	CO 7
14	Define subcooled liquid	If the temperature of the liquid water on cooling becomes lower than the saturation temperature for the given pressure, the liquid water is called a subcooled liquid.	Remember	CO 7
15	Define superheated vapour.	When the temperature increases above the saturation temperature (in this case 100°C), the vapour is known as the *superheated vapour*.	Understand	CO 7
16	What is degree of superheat ?	The difference between the superheated temperature and the saturation temperature at the given pressure is called the *degree of superheat*.	Remember	CO 7
17	Define dry vapor?	Vapour which has just completed evaporation. The pressure and temperature of the vapour are the saturation values.	Understand	CO 7
18	What is sensible heat of water?	It is defined as the quantity of heat absorbed by 1 kg of water when it is heated from 0°C (freezing point) to boiling point	Remember	CO 7
19	Define dryness fraction?	The term dryness fraction is related with wet steam. It is defined as the ratio of the mass of actual dry steam to the mass of steam containing it	Understand	CO 7
20	What are steam tables?	The values of the properties are determined theoretically or experimentally and are tabulated in the form of tables which are known as'*Steam Tables*'	Remember	CO 7
UNIT - IV				
1	What is pure subsance?	A pure substance is defined as a substance having a constant and uniform chemical composition	Understand	CO 11
2	What is the purpose of a psychrometric chart?	A psychrometric chart is a graphical representation of the psychrometric processes of air. Psychrometric processes include physical and thermodynamic properties such as dry bulb temperature, wet bulb temperature, humidity, enthalpy, and air density.	Remember	CO 11
3	What is WBT and DBT?	Wet Bulb Temperature (WBT in short) is a measure of how much moisture or water vapour is present in the air. The difference between the dry bulb	Remember	CO 11

		temperature and this determines how much dry the air is. If DBT-WBT is large, then the air has lower relative humidity.		
4	At what condition the dehumidification process will start?	In the general the cooling and dehumidification process is obtained by passing the air over coil through which the cool refrigerant, chilled water or cooled gas is passed. During the cooling and dehumidification process the dry bulb, wet bulb and the dew point temperature of air reduces.	Understand	CO 11
5	How is wet bulb temperature determined?	It is defined as the temperature of a parcel of air cooled to saturation (100% relative humidity) by the evaporation of water into it, with the latent heat supplied by the parcel. A wet-bulb thermometer indicates a temperature close to the true (thermodynamic) wet-bulb temperature.	Remember	CO 11
6	What is dew point a function of?	In short, the dew point is an accurate measurement of the moisture content in the air. When talking about a certain day feeling “muggy” or “sticky,” the dew point temperature is the more accurate term to use.	Understand	CO 11
7	How many independent properties are required to define the state of moist air?	Based on Gibbs' phase rule, the thermodynamic state of moist air is uniquely fixed if the barometric pressure and two other independent properties are known. This means that at a given barometric pressure, the state of moist air can be determined by measuring any two independent properties.	Remember	CO 11
8	Is dew point and wet bulb the same?	The dew point will be the lowest number, and the wet bulb will fall between those two. If you were to add water vapor (but not by evaporation directly within the air parcel), the dew point and the wet bulb would climb, while the dry bulb temperature would stay the same.	Understand	CO 11
9	Is saturation temperature the same as dew point?	Dew point temperature is defined as the temperature to which the air would have to cool (at constant pressure and constant water vapor content) in order to reach saturation. ... Dew point temperature is never greater than the air temperature.	Remember	CO 11
10	State Dalton’s law.	The pressure of a mixture of gases is equal to the sum of the partial pressures of the constituents.	Understand	CO 11
11	How do you find the dew point temperature?	This can be expressed as a simple rule of thumb: For every 1 °C difference in the dew point and dry bulb temperatures, the relative humidity decreases by 5%, starting with RH = 100% when the dew point equals the dry bulb temperature.	Understand	CO 11
12	What is humidity ratio?	Specific humidity is approximately equal to the mixing ratio, which is defined as the ratio of the mass of water vapor in an air parcel to the mass of dry air for the same parcel. As temperature decreases, the amount of water vapor needed to reach saturation also decreases.	Remember	CO 11
13	What is meant by sensible heat?	Latent and sensible heat are types of energy released or absorbed in the atmosphere. Latent heat is related to changes in phase between liquids, gases, and solids. Sensible heat is related to changes in	Understand	CO 11

		temperature of a gas or object with no change in phase.		
14	What is an example of latent heat?	″Latent heat″ is heat transferred in a process without change of the body's temperature, for example, in a phase change (solid/liquid/gas).	Remember	CO 11
15	What is the difference between absolute humidity and relative humidity?	Absolute humidity is the measure of water vapor (moisture) in the air, regardless of temperature. ... Warm air can hold far more moisture than cold air meaning that the relative humidity of cold air would be far higher than warm air if their absolute humidity levels were equal.	Understand	CO 11
16	Why is wet bulb temperature lower than dry bulb?	When people refer to the temperature (heat content) of the air, they are normally referring to the dry bulb temperature. ... The wet bulb temperature is always lower than the dry bulb temperature except when there is 100% relative humidity, making the wet bulb temperature a more accurate measurement of product temperature.	Understand	CO 11
17	How do you measure relative humidity?	Humidity is the measure of the amount of moisture in the air. A psychrometer is an example of a hygrometer.	Remember	CO 11
18	What is the relationship between humidity and dew point?	Relative humidity changes when temperatures change. Because warm air can hold more water vapor than cool air, relative humidity falls when the temperature rises if no moisture is added to the air	Understand	CO 11
19	State Avogadro's Law	The number of moles of any gas is proportional to the volume of the gas at a given pressure and temperature	Remember	CO 11
20	State Amagat's law.	Volume of a mixture of gases is equal to the sum of the volumes of the individual constituents when each exists alone at the pressure and temperature of the mixture.	Understand	CO 11
UNIT - V				
1	Define Otto cycle?	An Otto cycle is an idealized thermodynamic cycle that describes the functioning of a typical spark ignition piston engine. It is the thermodynamic cycle most commonly found in automobile engines	Remember	CO 12
2	What is meant by Brayton cycle?	A thermodynamic cycle using constant pressure, heat addition and rejection	Understand	CO 12
3	What is Vapour cycle?	A power cycle continuously converts heat (energy released. by the burning of fuel) into work, in which a working fluid. Repeatedly performs a succession of processes.	Remember	CO 12
4	What does pressure ratio mean?	The ratio of the stagnation pressure as measured at the front and rear of the compressor of a gas turbine engine. ... Overall compression ratio also means the overall cycle pressure ratio which includes intake ram.	Understand	CO 12
5	Define air standard efficiency?	The efficiency of engine using air as the working medium is known as an "Air standard efficiency.	Remember	CO 12
6	What are the processes in diesel cycle?	i) 1-2.....Adiabatic compression. (ii) 2-3.....Addition of heat at constant pressure. (iii) 3-4.....Adiabatic expansion. (iv) 4-1.....Rejection of heat at constant volume	Understand	CO 12

7	What are the processes in dual cycle?	*i*) 1-2—Adiabatic compression (ii) 2-3—Addition of heat at constant volume (iii) 3-4—Addition of heat at constant pressure (iv) 4-5—Adiabatic expansion (v) 5-1—Rejection of heat at constant volume	Remember	CO 12
8	What is the order of efficiencies with respect to compression ratio?	For a given compression ratio Otto cycle is the most efficient while the Diesel cycle is the least efficient.	Understand	CO 12
9	What is Brayton cycle?	Brayton cycle is a constant pressure cycle for a perfect gas.	Remember	CO 12
10	Define work ratio	Work ratio is defined as the ratio of network output to the work done by the turbine	Understand	CO 12
11	define refrigeration	Refrigeration is the science of producing and maintaining temperatures below that of the surrounding atmosphere.	Understand	CO 12
12	Define COP .	The ratio of heat absorbed by the refrigerant while passing through the evaporator to the work input required to compress the refrigerant in the compressor	Remember	CO 12
13	What is ton of refrigeration?	The refrigerating effect produced by the melting of 1 tonne of ice from and at 0°C in 24 hours.	Understand	CO 12
14	What are the processes of Bell colemon cycle?	(*i*) Absorption and rejection of heat are constant pressure processes and (ii) Compression and expansion are isentropic processes.	Remember	CO 12
15	What are processes of simple vapour compression system	1. Compression 2. Condensation 3. Expansion 4. Vaporisation.	Understand	CO 12
16	What is the function of expansion valve?	Its function is to meter the proper amount of refrigerant to the evaporator and to reduce the pressure of liquid entering the evaporator so that liquid will vaporize in the evaporator at the desired low temperature and take out sufficient amount of heat.	Understand	CO 12
17	What is the function of evaporator	An evaporator provides a heat transfer surface through which heat can pass from the refrigerated space into the vaporizing refrigerant.	Remember	CO 12
18	What is function of compressor?	The function of a compressor is to remove the vapour from the evaporator, and to raise its temperature and pressure to a point such that it (vapour) can be condensed with available condensing media.	Understand	CO 12
19	What is the effect of superheating?	Since the increase in work is more as compared to increase in refrigerating effect, therefore overall effect of superheating is to give a low value of C.O.P.	Remember	CO 12
20	What is sub cooling?	Sub-cooling' is the process of cooling the liquid refrigerant below the condensing temperature for a given pressure	Understand	CO 12

Signature of the Faculty
Ms. N SanthiSree, Assistant Professor

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