DEPARTMENT OF MECHANICAL ENGINEERING

ME 6301- ENGINEERING THERMODYNAMICS
TWO MARKS QUESTION AND ANSWER

1. Define the term thermal engineering.
Ans: Thermal engineering is the science that deals with the energy transfer to practical applications such as energy transfer power generation, refrigeration, gas compression and its effect on the properties of working substance.

2. What is meant by thermodynamic system? How do you classify it? (MU – Oct'99, Apr'2000: BRU – Apr'96; MSU – Apr'96)
Ans: Thermodynamic system is defined as the any space or matter or group of matter where the energy transfer or energy conversions are studied.

It may be classified into three types.
(a) Open system
(b) Closed system
(c) Isolated system

3. What is meant by closed system? Give an example.(BNU – Nov'95)
Ans: When a system has only heat and work transfer, but there is no mass transfer, it is called as closed system.
Example: Piston and cylinder arrangement.

4. Define a open system, Give an example.
Ans: When a system has both mass and energy transfer it is called as open system.
Example: Air Compressor.

5. Differentiate closed and open system. (MU – Apr'98, MKU – Nov'95)

Closed System	Open System
1. There is no mass transfer. Only heat and work will transfer.	1. Mass transfer will take place, in addition to the heat and work transfer.
2. System boundary is fixed one	2. System boundary may or may not change.
3. Ex: Piston & cylinder arrangement, Thermal power plant	3. Air compressor, boiler

6. Define an isolated system
Ans: Isolated system is not affected by surroundings. There is no heat, work and mass transfer take place. In this system total energy remains constant.
Example: Entire Universe

7. Define: Specific heat capacity at constant pressure. (MU – Oct'99)
Ans: It isdefined as the amount of heat energy required to raise or lower the temperature of unit mass of the substance through one degree when the pressure kept constant. It is denoted by C_p.

8. Define: Specific heat capacity at constant volume.
Ans: it is defined as the amount of heat energy required to raise or lower the temperature of unit mass of the substance through one degree when volume kept constant.

9. What is meant by surroundings?
Ans: Any other matter out side the system boundary is called as surroundings.

10. What is boundary?
Ans: System and surroundings are separated by an imaginary line is called boundary.

11. What is meant by thermodynamic property? (MU – Apr'2001; BRU – Nov'96; BNU – Nov'94)
Ans: Thermodynamic property is any characteristic of a substance which is used to identify the state of the system and can be measured, when the system remains in an equilibrium state.

12. How do you classify the property?
Ans: Thermodynamic property can be classified into two types.
1. Intensive or Intrinsic and
2. Extensive and Extrinsic property.

13. Define Intensive and Extensive properties. (MU – Oct'96,98; MKU – Apr'96)
Ans: The properties which are independent on the mass of the system is called intensive properties.
e.g., Pressure, Temperature, Specific Volume etc.,
The properties which are dependent on the mass of the system is called extensive properties.
e.g., Total energy, Total volume, weight etc.

14. Differentiate Intensive and Extensive properties (MU – Apr'99, Apr'2001; MSU – Nov'96)

Intensive Properties	Extensive Properties
1. Independent on the mass of the system	Dependent on the mass of the system.
2. If we consider part of the system these properties remain same. e.g. pressure, Temperature specific volume etc.,	If we consider part of the system it will have a lesser value. e.g., Total energy, Total volume, weight etc.,
3. Extensive property/mass is known as intensive property	--

15. What do you understand by equilibrium of a system?
Ans: When a system remains in equilibrium state, it should not undergo any charges to its own accord.

16. What is meant by thermodynamic equilibrium? (MU – Apr'98; MSU – Apr'96)
Ans: When a system is in thermodynamic equilibrium, it should satisfy the following three conditions.

(a) Mechanical Equilibrium :- Pressure remains constant
(b) Thermal equilibrium :- Temperature remains constant
(c) Chemical equilibrium : There is no chemical reaction.

17. State the First law of thermodynamics (MU – Apr'95)
Ans:First of thermodynamics states that when system undergoes a cyclic process the net heat transfer is equal to work transfer.

18. Define: PMM of first kind
Ans: PMM of first kind delivers work continuously without any input. It violates first law of thermodynamics, It is impossible to construct an engine working with this principle.

19. Define the term process (MKU – Nov'96)
Ans: It is defined as the change of state undergone by a gas due to energy flow.

20. Define the term Cycle: (MKU – Nov'96)
Ans: When a system undergoes a series of processes and return to its initial condition, it is known as cycle.

21. What is meant by open and closed cycle.
Ans: In a closed cycle, the same working substance will recirculate again and again.

In a open cycle, the same working substance will be exhausted to the surroundings after expansion.

22. What is meant by reversible and irreversible process. (MU – Apr'2001; BNU – Nov'94)
Ans: A process is said to be reversible, it should trace the same path in the reverse direction when the process is reversed. It is possible only when the system passes through a continuous series of equilibrium state.

If a system does not pass through continuous equilibrium state, then the process is said to be irreversible.

23. What is meant by Point and Path function? (Mu – Oct'2000; MKU – Nov'94)
Ans: The quantities which is independent on the process or path followed by the system is known as point functions.

Example: Pressure, volume, temperature, etc.,
The quantities which are dependent on the process or path followed by the system is known as path functions.
Example: Heat transfer, work transfer.

24. What is Quasi – Static process? (MU – Oct'98, Apr'2000 & 2001; BNU – Nov'95)
Ans: The process is said to be quasi – static, it should proceed infinitesimally slow and follows continuous series of equilibrium states. Therefore, the quasi static, it should proceed infinitesimally slow and follows continuous series of equilibrium states. Therefore, the quasi static process may be an reversible process.

25. Explain Zeroth Law of thermodynamics? (MU – Nov'94, Apr'2001; BRU – Apr'96)
Ans: Zeroth law of thermodynamics states that when two systems are separately in thermal equilibrium with a third system, then they themselves are in thermal equilibrium with each other.

26. Define the term enthalpy? (MU – Oct'99)
Ans: The Combination of internal energy and flow energy is known as enthalpy of the system. It may also be defined as the total heat of the substance.
Mathematically, enthalpy (H) = U + pv KJ)
Where, U – internal energy
p – pressure
v – volume
In terms of C_p & T $\rightarrow$ $H = mC_p(T_2-T_1)KJ$

27. Define the term internal energy (MKU – Apr'96)
Ans: Internal energy of a gas is the energy stored in a gas due to its molecular interactions.
It is also defined as the energy possessed by a gas at a given temperature.

28. What is meant by thermodynamic work?
Ans: It is the work done by the system when the energy transferred across the boundary of the system. It is mainly due to intensive property difference between the system and surroundings.

29. Define Heat.
Ans: Heat is the energy crossing the boundary due to the temperature difference between the system and surroundings.

30. Give the general gas energy equations. (MU – Apr'95 & 98)
Ans: dH = dE + dW.

31. State the law of conservation of energy (BRU – Nov'95)

Ans: Energy can neither be created nor destroyed, but it can be transferred from one form to another.

32. Define entropy of a pure substance. (MU – Oct'2000; MKU – Nov'96; BRU – Nov'95)

Ans: Entropy is an important thermodynamic property, which increases with addition of heat and decreases with its removal. Entropy is a function of temperature only. It is an unavailability of energy during energy transfer.

33. Define an isentropic process. (MU – Oct'99)

Ans: Isentropic process is also called as reversible adiabatic process. It is a process which follows the law of $pV^y = C$ is known as isentropic process. During this process entropy remains constant and no heat enters or leaves the gas.

34. Explain the throttling process.

Ans: When a gas or vapour expands and flows through an aperture of small size, the process is called as throttling process.

35. Work done in a free expansion process is _____ (MU – Apr'97)

Ans: Zero

36. Define free expansion process.

Ans: When a gas expands suddenly into a vacuum through a large orifice is known as free expansion process.

37. Which property is constant during throttling? (MU – Oct'98, Oct'2000)

Ans: Enthalpy

38. If in the equation $PV^n = C$, the value of n = then the process is called _____

Ans: Constant Volume process

39. The polytropic index (n) is given by _____ (MU – Apr'95 & 96)

Ans: n = log (P2/P1)/ log (V1/V2)

40. Work transfer is equal to heat transfer in case of _____ process.MU –Nov'94)

Ans: Isothermal process.

41. Write down the characteristic gas equation.

Ans: Characteristic gas equation is pV = mRT

Where,

p = pressure
V = Volume
R = Characteristic gas constant
T = Temperature.

42. What is meant by steady flow process? (BNU – Nov'96)

Ans: During the process the rate of flow of mass and energy across the boundary remains constant, is known as steady flow process.

43. What is the difference between steady flow and non – flow process?
Ans: During the steady flow process the rate of flow of mass and energy across the boundary remains constant.
In case of non – flow across the system and boundary.

44. State the Kelvin – Plank statement of second law of thermodynamics
Ans: Kelvin – Plank states that it is impossible to construct a heat engine working on cyclic process, whose only purpose is to convert all the heat energy given to it into an equal amount of work.

45. State Clausius statement of second law of thermodynamics.
Ans: It states that heat can flow from hot body to cold without any external aid but heat cannot flow from cold body to hot body without any external aid.

46. State Carnot's theorem.
Ans: No heat engine operating in a cyclic process between two fixed temperature, can be more efficient than a reversible engine operating between the same temperature limits.

47. What are the Corollaries of Carnot theorem.
Ans: (i) In all the reversible engine operating between the two given thermal reservoirs with fixed temperature, have the same efficiency.
(ii) The efficiency of any reversible heat engine operating between two reservoirs is independent of the nature of the working fluid and depends only on the temperature of the reservoirs.

48. Define – PMM of second kind.
Ans: Perpetual motion machine of second kind draws heat continuously from single reservoir and converts it into equivalent amount of work. Thus it gives 100% efficiency.

49. What is the difference between a heat pump and a refrigerator?
Ans: Heat pump is a device which operating in cyclic process, maintains the temperature of a hot body at a temperature higher than the temperature of surroundings.

A refrigerator is a device which operating in a cyclic process, maintains the temperature of a cold body at a temperature lower than the temperature of the surroundings.

50. What is meant by heat engine?
Ans: A heat engine is a device which is used to convert the thermal energy into mechanical energy.

51. Define the term COP?
Ans: Co-efficient of performance is defined as the ratio of heat extracted or rejected to work input.

$$COP = \frac{\text{Heat extracted or rejected}}{\text{Work input}}$$

52. Write the expression for COP of a heat pump and a refrigerator?
Ans: COP of heat pump

$$COP_{HP} = \frac{\text{Heat Supplied}}{\text{Work input}} = \frac{T_2}{T_2 - T_1}$$

COP of Refrigerator

$$COP_{HP} = \frac{\text{Heat extrated}}{\text{Work input}} = \frac{T_1}{T_2 - T_1}$$

53. What is the relation between COP_{HP} and COP_{ref}?
Ans: $COP_{HP} = COP_{ref} + 1$

54. Why Carnot cycle cannot be realized in practical?
Ans: (i) In a Carnot cycle all the four process are reversible but in actual practice there is no process is reversible.
(ii) There are two processes to be carried out during compression and expansion. For isothermal process the piston moves very slowly and for adiabatic process the piston moves as fast as possible. This speed variation during the same stroke of the piston is not possible.
(iii) It is not possible to avoid friction moving parts completely.

55. Name two alternative methods by which the efficiency of a Carnot cycle can be increased.
Ans: (i) Efficiency can be increased as the higher temperature T_2 increases.
(ii) Efficiency can be increased as the lower temperature T_1 decreases.

56. Why a heat engine cannot have 100% efficiency?
Ans: For all the heat engines there will be a heat loss between system and surroundings. Therefore we can't convert all the heat input into useful work.

57. When will be the Carnot cycle efficiency is maximum?
Ans: Carnot cycle efficiency is maximum when the initial temperature is 0°K.

58. What are the processes involved in Carnot cycle.
Ans: Carnot cycle consist of
i) Reversible isothermal compression
ii) isentropic compression
iii) reversible isothermal expansion
iv) isentropic expansion

59. Write the expression for efficiency of the carnot cycle.

$$\text{Ans: } n = \frac{T2 - T1}{T2}$$

60. Define: Thermodynamic cycles.
Ans: Thermodynamic cycle is defined as the series of processes performed on the system, so that the system attains to its original state.

61. Define the term compression ratio.
Ans: Compression ratio is the ratio between total cylinder volume to clearance volume. It is denoted by the letter 'r'

62. What is the range of compression ratio for SI and diesel engine?
Ans: For petrol of SI engine 6 to 8
For diesel engine 12 to 18.

63. Which cycle is more efficient for the same compression ratio and heat input, Otto cycle or Diesel cycle?
Ans: Otto cycle is more efficient than diesel cycle

64. Write the expression for efficiency of the otto cycle?
Ans:

$$\text{Efficiency } n = 1 - \frac{1}{(r)^{r-1}}$$

65. The efficiency of the diesel cycle approaches the otto cycle efficiency when the cut off ratio is _____
Ans: reduced

66. Which device is used to control the Air – fuel ratio in the petrol engine?
Ans: Carburettor

67. Which device is used to control the Air fuel ratio in the diesel engine?
Ans: Injection nozzle

68. The speed of a four stroke I.C. engine is 1500rpm. What will be the speed of the cam shaft?
Ans: 750 rpm.

69. All the four operations in two stroke engine are performed in _____ number of revolution of crank shaft.
Ans: one

70. All the four operations in four stroke engine are performed in _____ number of operations?
Ans: Two

71. In otto cycle the compression ratio is _____ to expansion ratio.
Ans: Equal

72. In diesel engine, the compression ratio is _____ than expansion ratio?
Ans: Greater

73. What is meant by cutoff ratio?
Ans: Cutoff ratio is defined as the ratio of volume after the heat addition to before the heat addition. It is denoted by the letter 'p'

74. What are the assumptions made for air standard cycle.
Ans:

1. Air is the working substance.
2. Throughout the cycle, air behaves as a perfect gas and obeys all the gas laws.
3. No chemical reaction takes place in the cylinder
4. Both expansion and compression are strictly isentropic
5. The values of specific heats of the air remain constant throughout the cycle.

75. What is the difference between otto and Diesel cycle.

Otto Cycle	Diesel Cycle
1. Otto cycle consist of two adiabatic and two constant volume process.	1. It consists of two adiabatic, one constant volume and one constant pressure processes.
2. Compression ratio is equal to expansion ratio	2. Compression ratio is greater than expansion ratio.
3. Heat addition takes place at constant volume.	3. Heat addition takes place at constant pressure
4. Compression ratio is less. It is varies from 6 to 8.	4. Compression ratio is more. It varies from 12 to 18.

76. What is the other name given to otto cycle?

Ans: Constant volume cycle.

77. What is meant by air standard efficiency of the cycle?
Ans: It is defined as the ratio of work done by the cycle to the heat supplied to the cycle.

$$\text{Efficiency } n = \frac{\text{Work done}}{\text{Heat supplied}}$$

78. Define: Mean effective pressure of an I.C. engine.
Ans: Mean effective pressure is defined as the constant pressure acting on the piston during the working stroke. It is also defined as the ratio of work done to the stroke volume or piston displacement volume.

79. What will be the effect of compression ratio on efficiency of the diesel cycle?
Ans: Efficiency increases with the increase in compression ratio and vice – versa.

80. What will be the effect of cut off ratio on efficiency of the diesel cycle.
Ans: Efficiency decreases with the increase of cut off ratio and vice – versa.

81. The thermal efficiency of a two stroke cycle engine is _____ than the four stroke cycle engine.
Ans: Lesser.

82. Define: Specific fuel consumption.
Ans: SFC is defined as the amount of fuel consumed per brake power hour of work.

83. What is meant by calorific value of a fuel.
Ans: Calorific value of a fuel is defined as the amount of heat liberated by the compete combustion of unit quantity of a fuel.

84. Give the expression for efficiency of the Dual cycle.
Ans:

$$\text{Efficiency } n = 1 - \frac{1}{(r)^{r-1}} \cdot \frac{Kpr - 1}{(K-1) + yK(p-1)}$$

where,

r – Compression ratio
k – pressure or Expassion ratio
p – cut off ratio and
y – adiabatic index

85. The efficiency of the Dual cycle is _____ than the diesel cycle and _____ than the otto cycle for the same compression ratio.

Ans: greater, less.

86. What are the factors influencing of the Dual cycle?
Ans: 1. Compression ratio 2.cut off ratio 3. pressure ratio and 4. heat supplied at constant volume and constant pressure.

87. The Brayton cycle is mainly used in _____
Ans: Gas turbine power plant.

88. Give the expression for efficiency of the Brayton cycle.
Ans:

$$\text{Efficiency } n = 1 - \frac{1}{(R_p)^{y-1}} \text{ where } R_p \text{ – pressure ratio.}$$

89. The two stroke cycle engine gives _____ the number of power strokes as compared to the four stroke cycle engine, at the same engine speed.

Ans : double.

90. In petrol engine, the charge is ignited with the help of _____
Ans : Spark plug

91. The diesel engine draws the mixture of diesel and air during suction stroke (True / False)
Ans : False.

92. What is the fuel injector?
Ans : Fuel injector is used in diesel engine to inject and atomize the diesel at the end of the compression stroke.

93. What is meant by SI engine ? Why it is called so ?
Ans : SI engine means spark ignition engine. In SI engine air fuel mixture is ignited by spark plug hence it is called spark ignition engine. It is also called as petrol engine.

94. Give four major difference between two stroke and four stroke IC engine.

No	Two stroke cycle engine	Four Stroke cycle engine
1	One cycle is completed in two stroke of the piston or one revolution of the crank shaft.	One cycle is completed in four stroke of the piston or two revolution of the crank shaft.
2	For the same speed, twice the number of power strokes are produced than 4 stroke engine.	For the same speed, half of the number of power strokes are produced than 2 stroke engine.
3	Turning moment is more uniform and hence lighter flywheel is used.	Turning moment is not uniform and hence bigger flywheel is used.

4	It contains ports which is operated by the piston movement.	It contains valves which is operated by valve mechanism.

95. What is meant by CI Engine ? Why it is called so ?

Ans : CI engine means compression ignition engine. In CI engine the fuel is injected by a fuel injector in atomized form because of high compressed air it gets ignited automatically. Hence it is called as compression ignition engine.

96. What is a two stroke engine ?

Ans : A two stroke engine is an engine in which one cycle of operation is completed in two stroke of the piston or one revolution of the crank shaft.

97. What is a four stroke engine ?

Ans : A four stroke engine is an engine in which one cycle of operation is completed in four stroke of the piston or two revolution of the crank shaft.

98. Name the four strokes of an IC engine?

Ans : Suction, compression, power and exhaust stroke.

99. Differentiate petrol and Diesel engines.

Petrol or SI engines	Diesel or CI engine
1. Combustion of air fuel mixture takes place by spark produced by sparkplug.	1. Combustion takes place by high compressed air.
2. Carburetor is used to mix the air fuel mixture.	2. Fuel injector is used to inject the fuel in atomized form.
3. Compression ratio varies from 6 to 8.	3. Compression ratio varies from 12 to 18.
4.It works on Otto cycle.	4. It works on Diesel or Dual cycle.

100. What is a Gas turbine? How do you classify.

Ans: Gas turbine is an axial flow rotary turbine in which working medium is gas.
Classification of gas turbine.
1. According to the cycle of operation
a) open cycle b) closed cycle and c) semi – closed cycle.
2. According to the process
a) constant volume and b) constant pressure process.

101. What is meant by closed cycle gas turbine?
Ans: In closed cycle gas turbine, the same working fluid is recirculated again and again.

102. What is meant by open cycle gas turbine?

Ans: In open cycle gas turbine, the exhaust gas form turbine is exhausted to the atmosphere and fresh air is taken in compressor for every cycle.

103. Gas turbine is working on ----cycle
Ans: Brayton or Jules cycle.

104. How can we increase the efficiency of the gas turbine?
Ans: By providing inter cooler, re-heater along with heat exchanges.

105. Differentiate open and closed cycle gas turbines.

Open cycle gas turbine	Closed cycle gas turbine
1. Working substance is exhausted to the atmosphere after one cycle.	1. The same working substance is recirculated again and again.
2. Pre-cooler is not required	2. Pre-cooler is required to cool the exhaust gas to the original temperature.
3. High quality fuels are used	3. Low quality fuels are used
4. For the same power developed size and weight of the plant is small	4. Size and weight are bigger.

106. What is the function of intercooler in gas turbines? Where it is placed?
Ans: The intercooler is placed between L.P. and H.P. compressors. It is used to cool the gas coming form L.P. compressor to its original temperature.

107. Why re-heater is necessary in gas turbine? What are its effects?
Ans: The expansion process is very often performed in two sperate turbine stages. The re-heater is placed between the H.P. and L.P. turbines to increase the enthalpy of the exhaust gas coming from H.P. turbine.
Effects:

1. Turbine output is increased for the same compression ratio
2. Thermal efficiency is less.

108. What is the function of regenerator in gas turbine?
Ans: The main function of heat regenerator is to exchange the heat from exhaust gas to the compressed air for preheating before combustion chamber. It increases fuel economy and increase thermal efficiency.

109. What is meant by single acting compressor?
In single acting compressor, the suction, compression and delivery of air take place on one side of the piston.

110. What is meant by double acting compressor?
In double acting reciprocating compressor, the suction compressin and delivery of air take place on both side of the piston.

111. What is meant by single stage compressor?

In single stage compressor, the compression of air from the initial pressure to the final pressure is carried out in one cylinder only.

112. Define clearance ratio

Clearance ratio is defined as the ratio of clearance volume to swept volume (or) stroke volume.

$$C = \frac{V_c}{V_s}$$

V_c – clearance volume

V_s – swept volume

113. What is compression ratio?

Compression ratio is defined as the ratio between total volume and clearance volume.

$$\text{Compression ratio} = \frac{\text{Total volume}}{\text{Clearance Volume}}$$

114. What are the factors that effect the volumetric efficiency of a reciprocating compressor?

1) Clearance volume 2) Compression ratio.

115. Compressor Capacity is

a) Volume of air delivered
b) Volume of air sucked
c) Both a and b
d) Nine of the above

Ans: (a)

116. Compressor capacity is highest, when the intake air temperature is _____

Ans: Lowest

117. Compressor capacity is expressed in _____

Ans: m^3/min

118. As the compression ratio increases, the volumetric efficiency of air compressor _____

Ans: Decreases.

119.A 50 m^3/min compressor can

a) Compress 50m^3/min of free air
b) Compress 50m^3/min of standard air
c) Deliver 50m^3/min of standard air
d) Deliver 50m^3/min of free air.

Ans: a)

120. For delivering large amount of air at low pressure
a) Rotary compressors are used
b) Reciprocating compressors are used
c) All engines are used
d) All the above
Ans: (a)

121. In gas turbine, type of rotary compressor used is _____
Ans: Axial flow compressor.

122. In Aeroplane, type of rotary compressor used is _____
Ans: Axial flow compressor.

123. What is the difference between complete (or) perfect inter cooling and incomplelte (or) imperfect inter cooling.

Perfect Inter cooling
When the temperature of air leaving the intercooler (T_3) is equal to the original atmospheric air temperature (T_1), then the inter cooling is known as perfect inter cooling.

Imperfect Inter cooling
When the temperature of air leaving the inter cooler (T_3) is more than original atmospheric air temperature (T_1), then the inter cooling is known as Imperfect inter cooling.

124. Power requirement of a refrigerator is _____
Ans: Inversely proportional to cop

125. In SI Units, one ton of refrigeration is equal to _____
Ans: 210KJ/min

126. The capacity of a domestic refrigerator is in the range of _____
Ans: 0.1 to 0.3 tonnes.

127. COP of a refrigerator working on a reversed carnot code is _____
Ans: $\frac{T_2}{T_1 - T_2}$

128. The vapour compression refrigerator employs the _____cycle
Ans: Reversed carnot

129. In vapour compression cycle the condition of refrigerant is dry saturated vapour _____

Ans: Before entering the compressor.

130. Give the 4 important parameters that are to be measured and controlled of an air conditioning system.

1. Temperature of air
2. Humidity of air
3. Purity of air
4. Motion of air

131. Name the cycles on which an Air refrigeration system works.

Ans: 1. Reversed carnot cycle 2. Bell – coleman cycle

132. Name four important properties of a good refrigerant

Ans:
1. Low boiling point
2. High critical temperature & pressure
3. Low sp.heat of liquid
4. Non – flammable and non explosive.

133. Name some of the equipments used in air conditioning system

Ans: 1. Filter
2. Cooling coil
3. Heating coil
4. Compressor
5. Condeser
6. Evaporator

134. Name any four commonly used refrigerants

Ans; 1. Ammonia (NH_3)
2. Carbon di oxide (CO_2)
3. Sulphur di oxide (SO_2)
4. Freon – 12.

135. What are the factors to be considered in air conditioning a room?

Ans: 1. Temperature of air
2. Humidity of air
3. Purity of air
4. Motion of air.

136. The door of a running refrigerator inside a room was left open. What will happen?

Ans: The room will be gradually warmed up.

137. Fourier's Law is based on assumption that _____

Ans: Heat transfer in steady state

138. A perfect black body is one which _____

Ans: Absorb heat radiation of all wave lengths falling on it.

139. The valve of the wave length for maximum emissive power is given by _____
Ans: Wein's Law

140. Thermal diffusivity of a substance is given by _____
Ans: $\frac{k}{pC_p}$

141. The unit for Stefan – Boltzman constant is _____
Ans: Watt/m^2/k^4

142. Two plates spaced 150mm apart are maintained at 1000°C and 70°c. The heat transfer will take place mainly by _____
Ans: Radiation.

143. Heat conducted through unit area and unit thick face per unit time when temperature difference between opposite faces is unity is called _____
Ans: Thermal conductivity

144. The amount of radiation mainly depends on _____
Ans: Nature of body, temperature of body and type of surface of body

145. What is meant by radiation shape factor?
The space factor is defined as the fraction of the radiative energy that is diffused from one surface element and strikes the other surface directly with no intervening reflections. It is represented by Fiji. Other names for the radiation shape factor are view factor, angle factor, and configuration factor.

146. Give the 3 basic expressions governing the 3 modes of heat transfer.
1) Fourier Law of conduction

$$Q = -KA \frac{dT}{dx}$$

where A – Area in m^2

$\frac{dT}{dx}$ - Temperature gradient in K/m

K – Therma conductivity W/mK

2. Newton's Law of cooling

$Q = hA(T_s - T_\infty)$

Where
H – heat transfer co – eff in W/m^2K

A – Surface Area in m^2

T_s – Surface Temperature in K

T_∞ - Fluid Temperature in K

3. Stefan – Boltzman Law

$E_b = \sigma T^4$
Where
σ - Stefan Boltzman constant = 5.669×10^{-8} $w/m^2 k^4$
T – Temperature in K

147. Define a black body
Black body is on ideal surface having the following properties.

1) A black body absorbs all incident radiation regardless of wave length and direction.
2) For a prescribed temperature and wave length, no surface can emit more energy than black body.

148. Given two examples of heat transfer with internal heat generation.
1. Chemical Reaction
2. Nuclear Reaction
3. Combustion Reaction.

149. Name the law which governs convection heat transfer
Ans: Newton's law of cooling

150. Write down the Stefan Boltzman law with its Unit
The total energy emitted by a black body at a particular temperature is given by
$Eb = \sigma T^4$
Where σ – Stefan Boltzman constant – 5.669×10^{-8} w/m^2k^4