

IV/IV B.TECH (REGULAR/SUPPLEMENTARY) DEGREE EXAMINATION

SCHEME FOR INSTITUTIONAL ELECTIVE

AIR POLLUTION & CONTROL (18CE101)

1. Answer all 10X1M=10M
- A) Define Air Pollution?
Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution.
- B) Name any two natural air pollutants?
Forest fires, Pollens, Dust storms etc. are example for natural air pollutants.
- C) Which gases are responsible for acid rain?
sulphur dioxide and nitrogen oxides are responsible for acid rain
- D) What is Environmental Lapse rate?
Rate of change of temperature with respect to altitude in atmosphere is called Environmental Lapse rate.
- E) Which instrument used for measuring wind speed?
Cup Anemometers is used for measuring wind speed.
- F) Name the instrument used to measure the humidity in atmosphere.
Hygrometer is used for humidity measurement
- G) What is effective height of stack?
Effective height of stack= [Physical height of stack + Plume Rise]
- H) List out the various objectives of controlling devices?
To prevent a variety of different pollutants, both gaseous and solid, from entering the atmosphere primarily out of industrial smokestacks.
- I) Write down minimum height of the stack as per board formulas?
Minimum height of stack as per Board formulas is 30 m.
- J) List out the SO_x control methods?
Desulphurization processes of Dry and Wet processes

UNIT-1

2. a) What are the various sources of air pollution? 5M
A/C to emission of pollutant into atmosphere: i) Stationary – point & area sources
ii) Mobile --line sources & area sources

(Explanation briefly with minimum of two examples ... 5M)

b) Explain effects of air pollution on vegetation? 5M

The effects of air pollution on plants are: (i) Sulphur dioxide bleach the surface of the leaves, causes loss of chlorophyll and results in yellowing of the leaves, especially in green leafy vegetable. (ii) Nitrogen dioxide results in the premature falling of leaves and suppressed growth of plants.

The effects of pollution on plants include mottled foliage, "burning" at leaf tips or margins, twig dieback, stunted growth, premature leaf drop, delayed maturity, abortion or early drop of blossoms, and reduced yield or quality.

[OR]

3. a) Explain the natural and artificial types of pollutants? 5M

A/C to the type of source:

- i) Natural sources--- pollutants emitted from this source are natural pollutants.
Ex. Forest fires, Dust storms, plant pollens, Volcanoes, Sea sprays etc.
- ii) Artificial or Manmade sources--- pollutants emitted from manmade activities are called artificial pollutants. These are classified in to three types namely Domestic, Industrial and Traffic sources.
Ex. Mosquito sprays, House cleaners, Chemical industries, vehicles

Natural-----2.5 M

Artificial-----2.5 M

5.0 M

b) Briefly explain about global environmental problem of Greenhouse effect? 5M

Definition & causes ----2M

Effects ----- 1.5 M

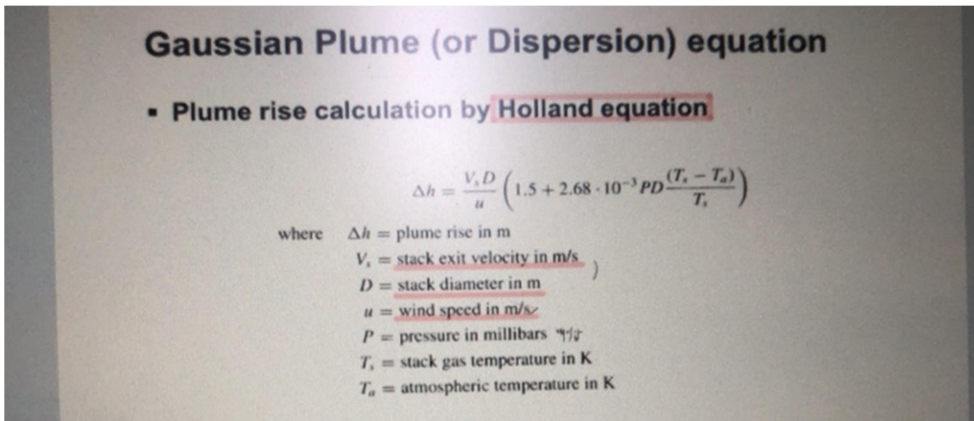
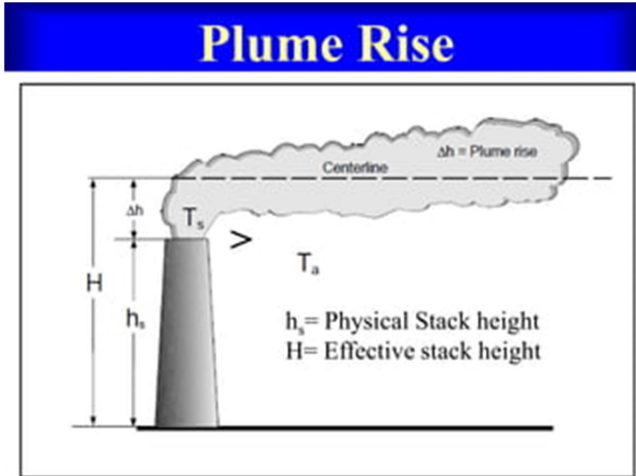
Control measures ---- 1.5 M

5.0 M

UNIT-II

4. a) What is Plume Rise? Mention various formulae for Plume Rise.

Plume Rise: The vertical elevation between the top of the stack to the center line of the plume is called plume rise.



Definition & figure --

2 M

Various formulae (Brigg's formula, Holland's Equation) --

3 M

5 M

- b) What is atmospheric stability and explain various atmospheric conditions with temperature profile graphs?

Atmospheric stability determines whether or not air will rise and cause storms, sink and cause clear skies, or essentially do nothing. Stability is dependent upon the Adiabatic Lapse

Rates and the Environmental Lapse Rate. We will eventually be able to compare a measured ELR with the DALR and determine the atmospheric stability condition.

1] $ELR > DALR$ --SUPER ADIABATIC LAPSE RATE -- UNSTABLE ATMOSPHERE

(Density of air is less than surrounding, so air continuous to rise up)

2] $ELR < DALR$ --SUB ADIABATIC LAPSE RATE -- STABLE ATMOSPHERE

(Pollution slowly dispersed and vertical motion is very less)

3] $ELR = DALR$ -- NEUTRAL LAPSE RATE

(This is air ideal condition)

4] $ELR = 0$ – ISO THERMAL

(No change of temperature with height)

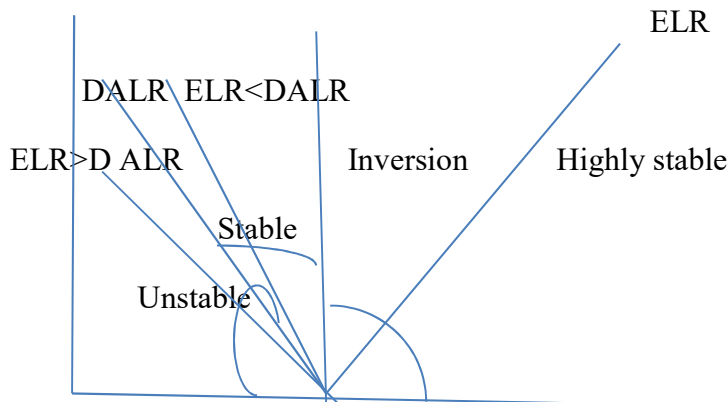
5] WHEN ELR IS NEGATIVE LAPSE RATE: IT INDICATES HIGHLY STABLE CONDITION

This is Inversion condition. Atmosphere temperature increases with altitude, then it is known as inversion. Highly stable is worse for pollutant dispersion.

EXPLANATION OF ATMOSPHERIC STABILITY --- 1 M

ATMOSPHERIC CONDITION WITH GRAPHS ---- 4 M

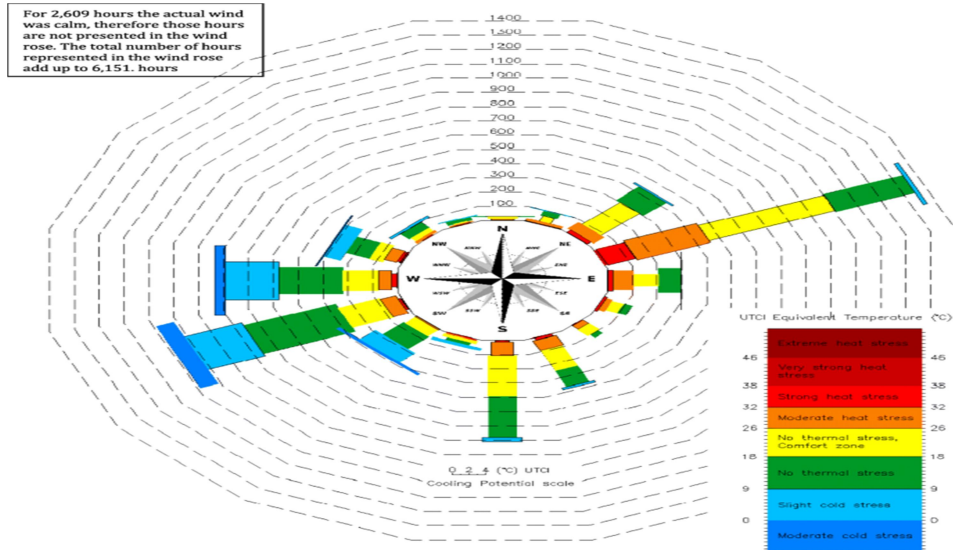
5 M



[OR]

5. a) Explain in brief about the wind rose with neat sketch 5M

Wind roses are **graphical charts that characterize the speed and direction of winds at a location**. Presented in a circular format, the length of each "spoke" around the circle indicates the amount of time that the wind blows from a particular direction.



EXPLANATION --2M

SKETCH --3M

5M

b) What are the meteorological parameters affecting the ambient air quality 5M

The meteorological parameters that influence the ambient air quality can be classified in to primary and secondary parameters.

Primary parameters:

1. Wind Direction & Speed
2. Temperature
3. Atmospheric Stability
4. Mixing Height

Secondary Parameter:

1. Precipitation
2. Humidity
3. Solar Radiation
4. Visibility

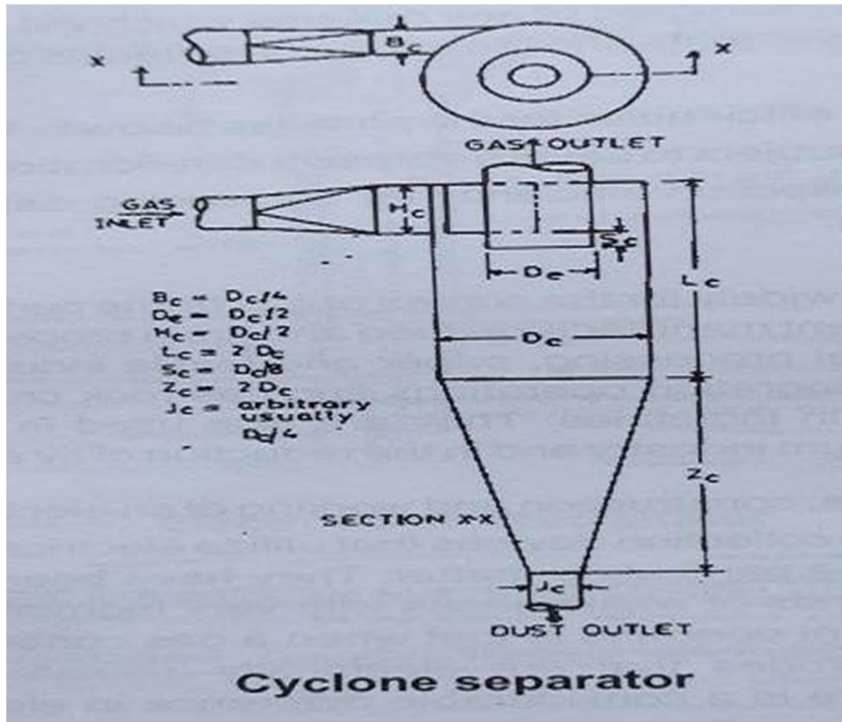
UNIT-III

6 .a) what are the various types of plume behavior? Explain with neat diagram. 5M

Plume behaviour refers to the dispersal pattern of gaseous pollutants in atmosphere depending upon wind conditions, atmospheric stability and vertical temperature profile. It shows seasonal as well as diurnal variations. Six types of plume behavior are shown in figure with temperature profile graphs

- 1) Looping
 - 2) Coning
 - 3) Fanning
 - 4) Lofting
 - 5) Fumigation
 - 6) Trapping
- | | |
|-------------|-------|
| List --- | 2M |
| Explanation | 3M |
| (Any two) | ----- |
| | 5M |

b) Explain about centrifugal separators with the help of diagram? 5M

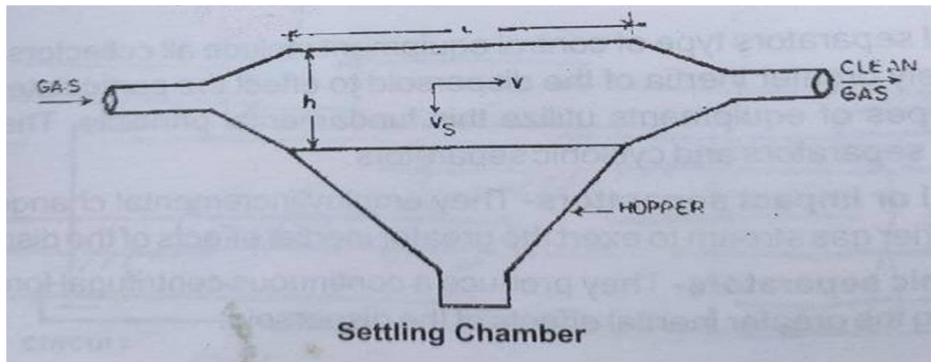


Sketch --- 3M

Explanation --- 2M

7. a) With a neat sketch, explain about Gravity settling chamber?

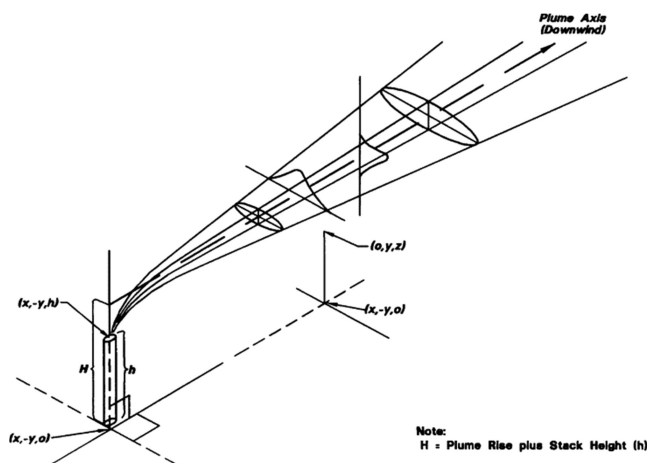
5M



Simple gravity separation is the basis of one of the oldest collection devices—the settling chamber. A settling chamber is a long, enlarged section in the exhaust system. As the cross-sectional area increases, there is a corresponding decrease in the exhaust gas velocity, which permits coarser particles to fall from the air suspension. Settling Chambers offer the advantages of modest construction, simple operation, dry collection, and small pressure drops. Structural space requirements are a significant disadvantage and are generally the limiting factor in use of settling chambers as primary collection methods. The design of a settling chamber is based on the settling velocity of the particles to be removed. Generally, chambers will have flow-through velocities less than 3 m/s and will effectively remove particles greater than 50 micron m in size. Dry collectors, such as scrapper and screw conveyors, are used to collect the settled particles

b) Describe in brief about Gaussian Dispersion Equation?

5M



$$C = \frac{Q}{\pi u \sigma_y \sigma_z} \exp - 0.5 \left(\frac{y}{\sigma_y} \right)^2 \left[\exp - 0.5 \left(\frac{H}{\sigma_z} \right)^2 \right]$$

C= Concentration of pollutant (g/m³) ;; σ_y, σ_z = Crosswind and vertical plume standard deviation in meters

Q= Pollutant release rate (g/s): u=mean wind speed in m/s

Theory with sketch -- 2M

Equation -- 3M

UNIT-IV

8. Explain the various controlling methods used to control gaseous pollutants. 10M

Five methods are available for controlling gaseous emissions: absorption, adsorption, condensation, chemical reaction, and incineration.

List 2M

Explanation (Any two) 8M

10M

[OR]

9. Explain in detail about SO_x Control methods? 10M

Following are the methods for control of SO_x :

1. Minimizing the SO₂ by making improvements in process technology
2. Using fuels of low sulphur content
3. Efficient dilution of gases by employing tall stacks
4. Reducing the concentration of SO₂ in stack gases by subsequent treatment: **Dry methods & Wet Methods**

List of methods --- 2M

Any one method explanation in detail --- 8M

(Dry or Wet Method)

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