

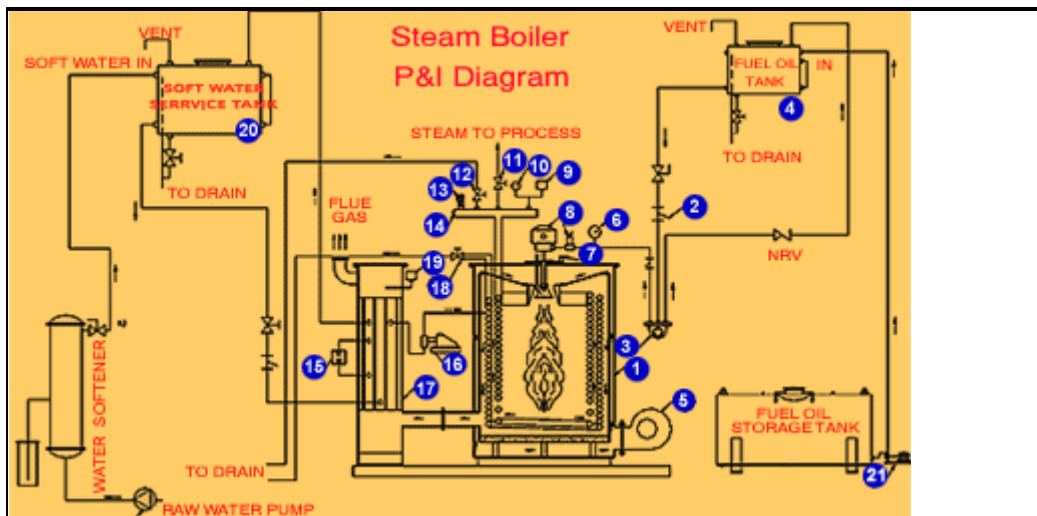
2 MARKS & QUESTION- ANSWERS
VII semester
EI 007 Power plant Instrumentation

1. Definition cogeneration:

A production of electricity and useful thermal energy simultaneously from a common fuel source. The rejected heat from industrial processes can be used to power an electric generator. Surplus heat from an electric generator can be used for industrial processes, or for heating purposes.

2. Sketch the P&I diagram of boiler.

**HOT WATER GENERATOR P&I
DIAGRAM**



3. What is the advantage of Hydro power plant?

- No pollution
- No need of fuel

4. Advantage of thermal power plant.

1. The fuel used is quite cheap.
2. Less initial cost as compared to other generating plants.
3. It can be installed at any place irrespective of the existence of coal. The coal can be transported to the site of the plant by rail or road.
4. It requires less space as compared to Hydro power plants.

5. Cost of generation is less than that of diesel power plants.

5. Disadvantage of thermal power plant.

1. It pollutes the atmosphere due to production of large amount of smoke and fumes.

2. It is costlier in running cost as compared to Hydro electric plants.

6. Why we can't completely depend on solar and wind power plant?

It is fully depend on the natural.

7. What is the renewable source of energy?

Water, solar, wind

8. What is the nonrenewable source of energy?

Petroleum

Coal

9. What are varies method of power generation?

Thermal power plant

Wind power plant

Hydro power plant

10. What is meant by pulverising of coal?

Crushing of **coal** and. during carbonization process

11. Give major building block of thermal power plant?

Coal and ash handling

Steam generation

12. Mention the use of conveyer?

Transport the material from one place to other.

13. Water the pollution occurs due to thermal power plant?

Water pollution

Air pollution

14. Application of co generation.

Efficiency Gains

Moderate Temperature

Saturated Steam

15. What are the fuels used in nuclear power plant?

U-238

16. Define fusion.

Nuclear fission is the splitting of the [nucleus](#) of an atom into parts (lighter [nuclei](#)) often producing [free neutrons](#) and other smaller nuclei, which may eventually produce [photons](#) (in the form of [gamma rays](#)). Fission of heavy elements is an [exothermic reaction](#) which can release large amounts of [energy](#) both as [electromagnetic radiation](#) and as [kinetic energy](#) of the fragments ([heating](#) the bulk material where fission takes place). Fission is a form of [elemental transmutation](#) because the resulting fragments are not the same [element](#) as the original atom.

17. Define Chain reactions.

Many heavy elements, such as [uranium](#), [thorium](#), and [plutonium](#), undergo both [spontaneous fission](#), a form of [radioactive decay](#) and *induced fission*, a form of [nuclear reaction](#). Elemental isotopes that undergo induced fission when struck by a free [neutron](#) are called [fissionable](#); isotopes that undergo fission when struck by a [thermal](#), slow moving neutron are also called [fissile](#). A few particularly fissile and readily obtainable isotopes (notably ^{235}U and ^{239}Pu) are called [nuclear fuels](#) because they can sustain a chain reaction and can be obtained in large enough quantities to be useful

18. Define nuclear reactor

nuclear reactor is a device in which [nuclear chain reactions](#) are initiated, controlled, and sustained at a steady rate, as opposed to a [nuclear bomb](#), in which the chain reaction occurs in a fraction of a second and is uncontrolled causing an explosion

19. Define fission.

The splitting apart of an atom's nucleus, releasing a large amount of heat energy.

20. Importance of instrumentation in thermal power plant.

Measure the variables to control

UNIT II

21. Define Humidity.

It is basically moisture content in air or it is the quantity of water vapour retained by gas.

22. Define Absolute Humidity.

Weight of water vapour in unit weight of gas.

$$H = W_r / W_g$$

23. Define Hygrometer.

Used to measure the moisture content in air. It also used to measure humidity.

24. What are the various methods of measurement of moisture.

Based on the weight of the particle

Based on the resistance, capacitance,

25. What are the different types of orifice?

Concentric orifice

Eccentric

Segmental

Quadrant edge

26. What are the disadvantages of pitot tube?

They can become plugged with sediment and that the pressure difference sensed may not be large enough to give the desired accuracy for the flow rate under consideration.

27. Define stagnation point.

Fluid approaching the object starts losing its velocity till directly in front of the body where the velocity is zero. This point is known as stagnation point.

28. Define Dall tube

It is an obstruction type primary element, used for fluid flow measurement. It produces large differential pressure with low pressure loss.

29. What are the different types of positive displacement meters?

Reciprocating piston type

Rotating vane type

Nutating disk type

Lobed impeller type

Oscillating piston type

30. List the disadvantages of reciprocating piston type

high cost
subject to leakage
problems created by dirty particle
high maintenance cost
restricted to moderate flow rates

31. Write any two points of calibration of flow meter

(i) wet meter- manometer which is calibrated with mercury
(ii) dry meter- manometer which is calibrated with mercury

32. list the advantage of oscillating piston type

good accuracy
can be easily applied to automatic liquid batching system
good repeatability
moderate cost

33. list the disadvantage of oscillating piston type

available in small size
suitable for clean fluids

34. what is the principle of densitometer

float density less than the fluid density, level increases float moves up, resistance connected
float varies, so output varies. Voltage output is proportional to the density of the fluid.

35. list the advantages of nutating disk type.

Less cost
Good accuracy
High temperature & pressure ratings

36. list the disadvantages of nutating disk type

Heavy accuracy decreases in increase flow rate

37. what is Rotameter?

It is an example of variable area flow meter. When fluid enters lopped moves from the bottom to top. Distance is proportional to the flow rate.

38. Explain the principle of calorimeter flow meter

consist of two coil type resistance thermometer, difference of temperature between the thermometer is maintained constant.

39. List some example of inferential flow meter.

Turbine flow meters

Target flow meters

Ultrasonic flow meters

40. list the advantages of electromagnetic flow meter?

It can handle slurries & corrosive fluids

It has low pressure drop

It can be used as bi-directional meter

Available in large pipe size & capacities

Unit III

41. 10. Specify the classification of IR region of spectrum.

1. photographic region

2. very near IR region (overtone region)

3. near IR region (vibration rotation region)

4. far IR region (rotation region)

42. Name the instruments used in IR spectrometry.

1. IR radiation sources

2. monochromators

3. sample cells

4. detectors.

43. name few IR radiation sources.

1. incandescent source

2. nernst glower

3. globar source

4. mercury arc.

44. Give the advantages of grating monochromators

1. gratings can be made with materials like aluminium which are not affected by moisture.

2. grating monochromators can be used over wide wavelength ranges

45. Give 4 different techniques used for sampling of solids.

1. solids run in solution

2. solid film techniques

3. null techniques

4. pressed pellet technique

46. Name two different types of IR spectrometers

1. dispersive IR spectrometers

2. nondispersive IR spectrometers

46.. chromatography ,a short note.

Chromatography is defined as the physical and chemical method of separation between various components of a mixture into pure fractions or bands of each component.

47.what are the different types of gas chromatography?

The different types of gas chromatography are æ_Gas liquid chromatography æ_Gas solid chromatography.

48.Define retention time

The time required for each of the components to emerge from sample or mixture is called as the retention time.

49.Name the different parts of gas chromatography?

- Sample injection system
- Chromatographic column
- Thermostat
- Detector
- Recorder.

50.Explain the selection criteria for carrier gas.

The selection criteria for carrier gas are É_It should be very cheap É_It should have high thermal conductivity É_It should be inert É_The carrier gas should be selected according to the type of detector used.

51. Explain chromatographic column.

The column acts as the heart of a gas chromatography, where the fundamental process of separation takes place. Its action is based on the fact that when a sample of gas or vapour is introduced into the column, it spreads by molecular diffusion to give a concentration profile.As the sample moves through the column, additional spreading takes place. But, the band maintains the general shape, which is detected and recorded as a chromatographic peak.

52.What is pyrolysis?

Pyrolysis is an accepted method of handling solid samples. It extends gas chromatographic analysis to compounds such as rubber , soil, textiles, coals, resins, polymers, paint films etc.

The method lends itself to studies on heat stability and thermal decomposition. It is also called as controlled thermal fragmentation.

53.List some detectors in gas chromatography .

- Thermal conductivity detector
- Flame ionization detector
- Thermionic emission detector

- Electron capture detector
- Flame photometer detector
- Photo ionization detector
- Electrolytic conduction type of detection
- Dual detector

54. Give the principle of Gas-Solid chromatography.

When a gas or vapour comes in contact with an adsorbent, certain amount of it get adsorbed on the solid surface. This takes place according to a phenomenon called Langmuir phenomenon given by

$$X/m = k_1c/k_2 + c$$

where k_1, k_2 are constants

x = mass of gas or vapour adsorbed

m = mass of adsorbent

c = vapour concentration in gas phase

55. Give the principle of Gas-Liquid chromatography.

If the vapour or gas comes in contact with a liquid, a fixed amount of it gets dissolved in the liquid. This takes place according to Henry's law of partition given by

$$x/m = kc$$

where m = mass of liquid used

c = vapour concentration in the gas phase

x = mass of gas

k = constant

56. What are the advantages of gas chromatography?

The advantages of gas chromatography are

- Good accuracy and precision
- High sensitivity
- Apparatus cost is cheaper than liquid chromatography
- Shorter time of analysis
- Longer life of the instrument.

57. Write the features of thermal conductivity detector. It is simple, inexpensive, non-selective and non-destructive and displays a

universal response. Being non-destructive, the column effluent can be passed through a TCD and

then into a second detector. The sensitivity is 0.3 ng/ml. The linearity is between 10^4 to 10^5 . It is particularly suitable for fraction correction and preparative gas

chromatography.

58. On what factor does the choice of detector will depend on liquid chromatography?

- Good sensitivity
- Better selectivity
- The detector must be able to operate in the presence of background signal
- The response time of the detector must be compatible with chromatography

59. What are the limitations of bulk property detector?

Limitations :

It is insensitive

It requires good temperature control.

60. What are the different types of liquid chromatography?

The different types of liquid chromatography are Liquid-liquid chromatography, Liquid-solid chromatography, Ion exchange chromatography or Bonded phase chromatography, Exclusion chromatography

UNIT IV

61. What are the two segments of Nyquist contour.

- i. A finite line segment C_1 along the imaginary axis.
- ii. An arc C_2 of infinite radius.

62. What are root loci.

The path taken by the roots of the open loop transfer function when the loop gain is varied from 0 to ∞ are called root loci.

63. What is a dominant pole.

The dominant pole is a pair of complex conjugate pair which decides the transient response of the system.

64. What are the main significances of root locus.

- i. The main root locus technique is used for stability analysis.
- ii. Using root locus technique the range of values of K , for a stable system can be determined

65. What are the effects of adding a zero to a system.

Adding a zero to a system increases peak overshoot appreciably.

66. What are N circles.

If the phase of closed loop transfer function with unity feedback is α , then $\tan \alpha$ will be in the form of circles for every value of α . These circles are called N circles.

67. What is a control system?

A system consists of a number of components connected together to perform a specific function. In a system when the output quantity is controlled by varying the input quantity then the system is called a control system.

68. What are the two major types of control system?

The two major types of control system are open loop and closed loop

69. Define open loop control system.

The control system in which the output quantity has no effect upon the input quantity are called open loop control system. This means that the output is not feedback to the input for correction.

70. Define closed loop control system.

The control system in which the output has an effect upon the input quantity so as to maintain the desired output value are called closed loop control system.

71. What are the components of feedback control system?

The components of feedback control system are plant, feedback path elements, error detector and controller.

72. Define transfer function.

The T.F of a system is defined as the ratio of the laplace transform of output to laplace transform of input with zero initial conditions.

73. What are the basic elements used for modeling mechanical translational system.

Mass, spring and dashpot

74. What are the basic elements used for modeling mechanical rotational system?

Moment of inertia J , dashpot with rotational frictional coefficient B and torsional spring with stiffness K

75. Name two types of electrical analogous for mechanical system.

The two types of analogies for the mechanical system are

Force voltage and force current analogy

76. What is block diagram?

A block diagram of a system is a pictorial representation of the functions performed by each component of the system and shows the flow of signals. The basic elements of block diagram are block, branch point and summing point.

77. Distinguish between open loop and closed loop system

Open loop	Closed loop
1. Inaccurate	Accurate
2. Simple and economical	Complex and costlier
3. The changes in output due to external disturbance are not corrected	The changes in output due to external disturbances are corrected automatically
4. They are generally stable	Great efforts are needed to design a stable

78. What is servomechanism?

The servomechanism is a feedback control system in which the output is mechanical position (or time derivatives of position velocity and acceleration.)

79. What is an order of a system.

The order of a system is the order of the differential equation governing the system. The order of the system can be obtained from the transfer function of the given system.

80. Define Damping ratio.

Damping ratio is defined as the ratio of actual damping to critical damping.

UNIT V

81. Define Delay time.

The time taken for response to reach 50% of final value for the very first time is delay time.

82. What is the principle of manometer?

The manometer is the simplest measuring instrument used for measuring low pressure ranges by balancing the pressure against the weight of a column of liquid. The action of all manometers depends on the effect of pressure exerted by a fluid at a depth.

83. Write some applications of pressure measurements.

- Pressure measurement helps in determining the liquid level in tanks and containers.
- Pressure measurement helps in determining the density of liquids.
- Used in many flow meters. Eg. Venturi meter, Orifice meter etc.,
- Pressure measurement is also required in day-to-day situations such as maintaining optimal pressure in tubes of vehicles tyres.

84. What is bellows element?

The bellows element is cylindrical in shape and the wall of this cylinder is thin and corrugated. The wall of this bellow is about 0.1mm thick and is made of some springy material such as stainless steel, brass or phosphor bronze. This bellows element is open at one end to receive the applied pressure and is closed at its other end. This other end is usually attached with a rod. In many cases a spring is placed inside the bellows to regain its original shape when the applied pressure is relieved.

85. Define. Ionization

Ionization is the process of knocking off an electron from an atom and thus producing a free electron and a positively charged ion.

86. What is dead weight tester?

The laboratory standard of pressure is a dead weight tester and it is very often used to calibrate Bourdon gauges.

87. Give the shapes of bourdon tubes available?

- C-shape
- Helical shape
- Spiral shape

90. What are the errors present in manometer?

- Effect of temperature
- Capillary effect
- Effect of variable meniscus

91. What are the fluids used for manometers?

The most common fluids used in manometers are water, red oil, and mercury. To minimize the effects of freezing and evaporation, kerosene or anti-freeze may be used.

92. What is the principle of operation of an ionization gauge?

It follows Boyle's law, which is at constant temperature, the ratio of pressure of two gauges is equal to the ratio of two densities.

93. On what factors the deflection of bellows depends?

Bellows are the substitutes for multi stack diaphragms. The flexibility of bellows is directly proportional to,

- Number of convolutions
- Square of the outside diameter of the Bellows

Inversely proportional to,

- The cube of the wall thickness
- The Young's modulus of elasticity
-

94. Mention some temperature sensor.

Thermocouple
Thermistors
RTD

95. Define speed.

Speed is defined as distance traveled by a body in unit time.

95. Name the speed measuring device.

Tachometer

96. List the direct level measuring methods.

Float type level indicator
Displacer type detector
Sight glass type.

97) List the indirect level measuring methods.

Hydrostatic measurement

Air purge system

Boiler drum system.

98) What are the advantages of sight glass level instrument?

Direct reading is possible.

Special designs are available.

Glass less devices are available in numerous material for corrosion resistance.

99) What are the advantages of displacer level instrument?

High accuracy

Reliable to clean liquids

100. What is micro manometer?

A micro manometer is used for the accurate measurement of extremely small pressure differences.

101. What is the principle of McLeod gauge?

McLeod gauge operates by taking in a sample volume of gas from a vacuum chamber, and then compressing it by tilting, and infilling with mercury. The pressure in this smaller volume is then measured by a mercury manometer, and then knowing the compression ratio, the pressure of the original vacuum can be determined.

102. Give the types of thermal conductivity gauges.

- Pirani gauge
- Thermocouple type conductivity gauge
- Ionization gauge

103. Give the advantages pressure measurement using bellows.

- Simple and rugged construction
- Moderate cost
- It is useful for low, medium and high pressure measurement
- Their applicability for use in measurement of absolute, gauge and differential pressures

