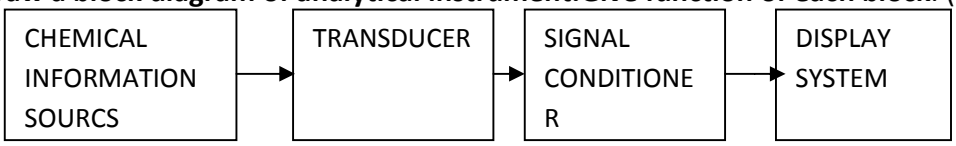
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1 a) Attempt any THREE of the following. 12marks

i) **Draw a block diagram of analytical instrument.Give function of each block.** (2marks+2m)



characteristic module ←----------processing module--------- -----→

1**)chemical information source**—It generates a set of signal containing necessary information. It may be the sample itself.

2)processing module-

Transducer: It converts the signal to a one of the different nature. It is generally used to convert nonelectrical phenomenon associated with the analysis of the sample. for eg. Photodiode.

3)Signal Conditioner: It converts the o/p of transducer in to an electrical quantity suitable for operation of the display system.2)It also increases sensitivity of instrument by amplification of original signal.

4)Display System: It provide a visible presentation of quantity as a displacement of scale or chart or record.

ii)Write stepwise procedure to sterilize medical instruments using AUTOCLAVE

PROCEDURE (01 mark for each step)

1)keep waste in the autoclave.

2) power on the supply.

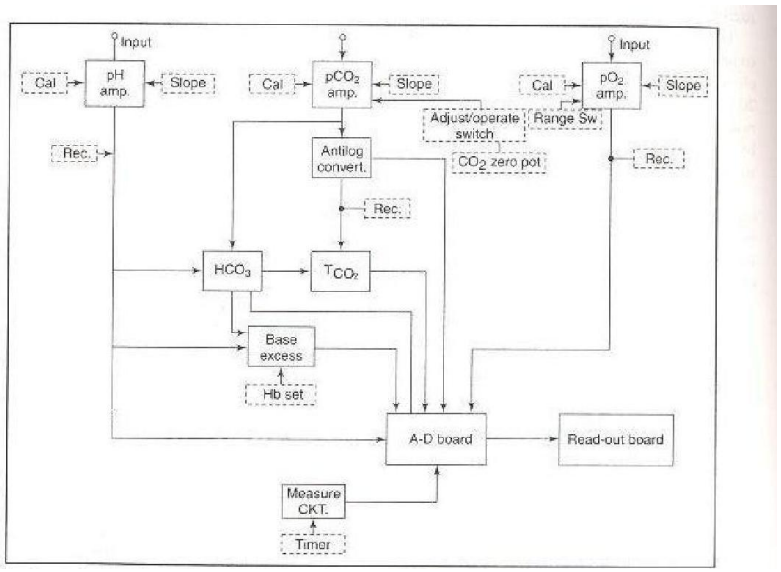
3)set timing for sterilization.

4)keep the desired pressure for sterilization until the point of condensation at which it draws more steam to the area.

iii)Draw a block diagram of blood gas analyzer &describe it. (2marks+2m)

- It is designed to measure PH,Pco2,&Po2 from a single sample of whole blood.
- Here separate sensors are used ton sense PH,Pco2,&Po2.
- It contains three high i/p impedance amplifier designed to operate in the specific range of each measuring electrode.
- A separate assembly is there to control the electrode.
- A vacuum system provides aspiration and flushing service for all three electrode.
- Calibrating gases are selected by a special push button control and passed through a sample chamber.

- Two standard buffers of known ph. Are given for calibration of analyzer.



iv) State types of electronic microscope. Also list it's different parts.(02marks+2m)

Types of Electronic microscope .1)SEM:Scanning Electron Microscope.

2) TEM:Transmission Electron microscope

Different parts.1)light source (Any four)

2)mirror lenses.

3)condenser system

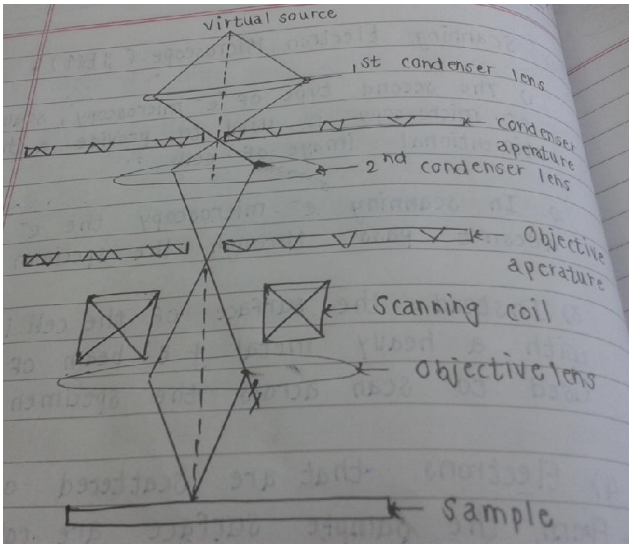
4)diaphragm

5)Eye piece.

6)photomiographic system

b) Attempt any ONE of the following. 06marks

i) Draw diagram of scanning a emission microscope and give its construction and working(2marks+2m+2m)



1)Construction;

- The dia. Is as shown .virtual source at the top represents the electron gun producing a stream of monochromatic electrons.
- The stream is condensed by the first condenser lens. It eliminate the high angle electrons from the beam.
- The second condenser lens forms the electrons in to a thin. Tight coherent beam and controlled by current knob.
- User-selectable objective aperture further eliminate high angle electrons from the beam.
- A set of coils then scans the beam.
- The objective lens scans the desired part of specimen..this is repetitive process.

Working:

- Here the surface of the cell is coated with a heavy metal & a beam of electron is used to scan across the specimen.

Electrons that are scattered or emitted fom the sample surface are collected to generate a 3 dimensional image..

ii) Draw neat diagram of centrifuge .State its working principle construction. List any two application.

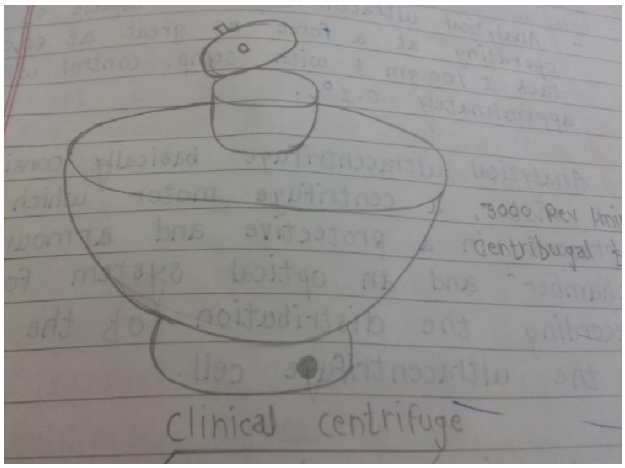


Diagram of Clinical centrifuge (01 Marks)

Working principal of centrifuge. (02 MARKS)

It is a device that spins liquid sample at a high speed &create a strong centripetal force causing the denser material to travels towards bottom of centrifuge tube more rapidly than gravitational force.

The basic idea behind centrifuge is the sedimentation process & it is depend n the applied centrifugal force.

Clinical centrifuge:

Construction: (02 MARKS)

- It is simple &small.
- Rotor is mounted vertically on a rigid shaft, therefore centrifuge tubes must be placed diametrically opposite to each other balancing their weight accurately.
- **APPLICATION (any 2) (01 MARK)**
  1. ISOLATE RED BLOOD CELL, yeast cell
  2. Isolate bulked precipitates of chemical reaction.

Q.2 Attempt any FOUR of the following. 16marks

a) Draw neat labelled diagram of gas chromatography and describe it.(02marks+02m)

Ans:-(02 Mark)

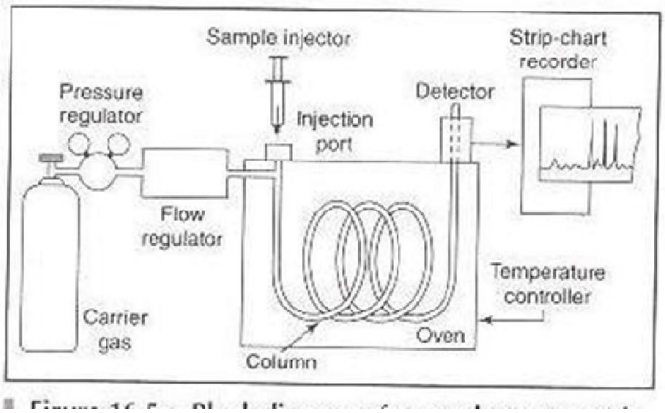


Diagram of Gas chromatography

The basic parts of a gas chromatograph are shown in figure**(02 Mark)**

It consists of the following parts.(02 Mark)

- Carrier gas supply along with pressure regulator and flow monitor.

- Sample injection system.

- Chromatographic column

- Thermal compartment of thermostat

- The detection system

- The strip chart recorder

The carrier gas, normally N_2, Ar or He is usually available in a compressed form in a cylinder fitted with a suitable pressure regulator. The gas is conducted from the cylinder through a flow regulator, to a sample injection port maintained at a certain temperature T_1, which is such that it ensures rapid vaporization, but not thermal degradation of the solute. Gas and liquid samples are almost always injected by syringe through a self sealing silicon rubber diaphragm in the injection port. The solute vapor mixes almost instantaneously with the flowing carrier gas and is swept into the chromatographic column, which is the heart of the chromatography.

It is there that the different solutes in the vaporized sample are separated from each other, by virtue of their different interaction with the column packing. The column is maintained at another temperature T_2. This temperature determines the time for the passage of the solutes and to some extent, the resolution and efficiency obtained with a particular column. At the end of the column the solutes emerging individually enter the detector which produces an electrical signal corresponding to the quantity of solute leaving the column. The detector signal is supplied to a potentiometer recorder and a plot of the time signal amplitude called chromatogram is obtained.

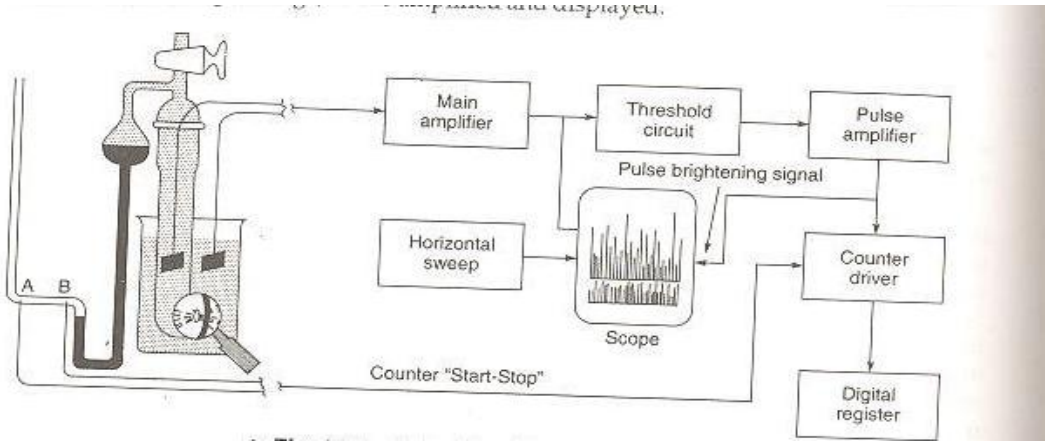
b) Draw a neat diagram of electro-conductive blood cell counter and describe its working.

Ans:-

Description :(02 Mark)

Blood cell counters operating on the principle of conductivity change which occurs each time a cell passes through an orifice are generally known as coulter counters. The technique is extremely useful for determine the number and size of the particles suspended in an electrically conductive liquid.

The principle of the measurement is that blood is a poor conductor of electricity whereas certain diluents are good conductors. For a cell count, blood is diluted and the suspension is drawn through a small orifice. By means of a constant current source a direct current is maintained between two electrodes located on either side of the orifice. As a blood cell is carried through the orifice, it displaces some of the conductive fluid and increases the electrical resistance between the electrodes. A voltage pulse of magnitude proportional to the particle volume is thus produced. The resulting series of pulses are electronically amplified, scaled and displayed on a suitable display

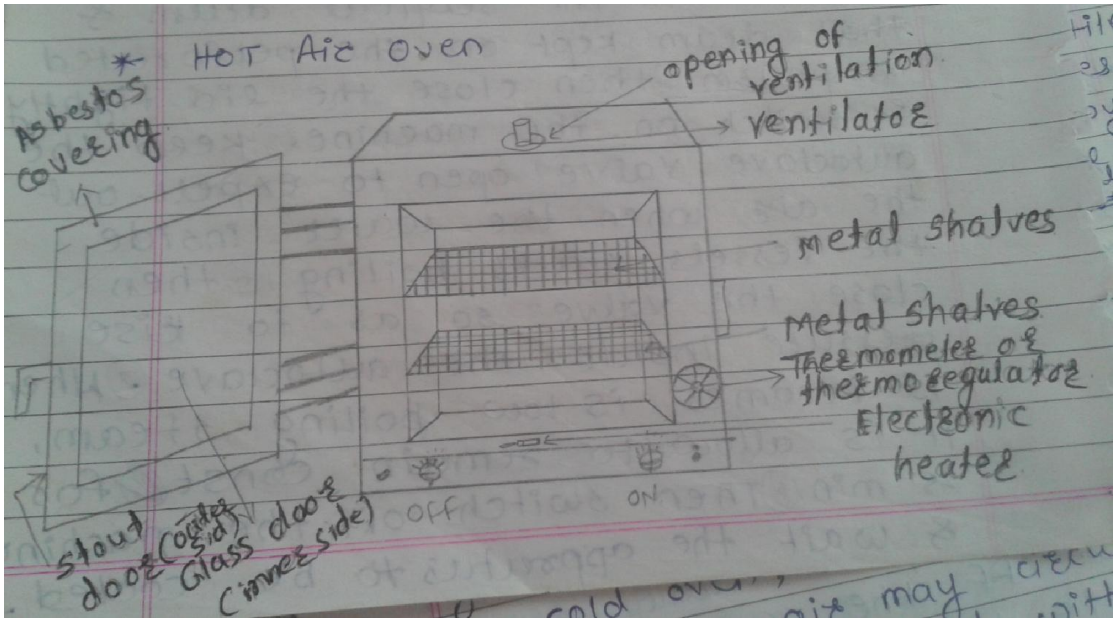


(02 Mark)

Diagram Electroconductive blood cell counter

c) Draw diagram of hot air oven and describe its construction .List any two application.(02m++01m+01m)

Ans:(02 Mark)



- **Construction**:-.**(01 Mark)**
- Double walled, the motor fixed at the back / triple walled, ducted air flow type, the motor fixed at the top. The motorized forced air circulation to maintain uniform temperature inside the chamber.Inner chamber made of stainless steel.Outer chamber made of mild steel.Gasket Asbestos rope or Neoprene rubber (optional) gaskets for the door to avoid air leakage and temperature loss of hot air oven.Trays Two/ Three perforated removable stainless steel trays at the fixed distance.Front panel consists of mains ON/OFF rocker switch

Application:- (1/2 Mark each=01)

1. Hot air ovens are electrical devices used in sterilization. It uses dry heat to sterilize articles.

2. These are widely used to sterilize articles that can with stand high temperatures and not get burnt like glass wares and powders.

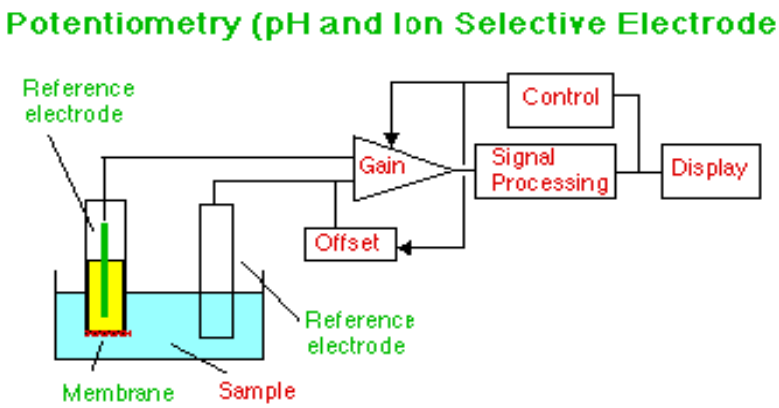
d) Compare dual beam spectrophotometer with single beam beam spectrophotometer (any04marks)

Ans:-

Dual beam spectrophotometer	**Single beam spectrophotometer**
1.while a double beam spectrophotometer has two beams of light	1. A single beam spectrophotometer has only one beam of light
2. High accuracy.	2.As compare to dual beam less accuracy
3.Double beam spectrophotometers operate faster and provide more reproducible results because they perform an automatic correction for the loss of light intensity as the beam passes through the sample and reference solution	3.In single-beam instruments, because there is only one light path which passes through the sample, it therefore requires manually switching a reference cuvette with the sample cuvette for calibration
4. Greater reproducibility.	4.Less reproducibility.

e) Draw the neat labelled diagram of PH meter. List its two technical specifications(02marks+02m).

Ans:- **(02 Mark)**



or any other diagram

Specification: - any 2 (02 Mark)

Ph range 0-14 pH

Resolution 0 .01 of ph

Accuracy +/- 0.01pH

Mv range -1999 mv to 1999 mv

Temp. measurement range 0 to 100 degree centigrade

f) Draw diagram of capillary electrophoresis and describe it.(02marks+02m)

Ans:- (02 Mark)

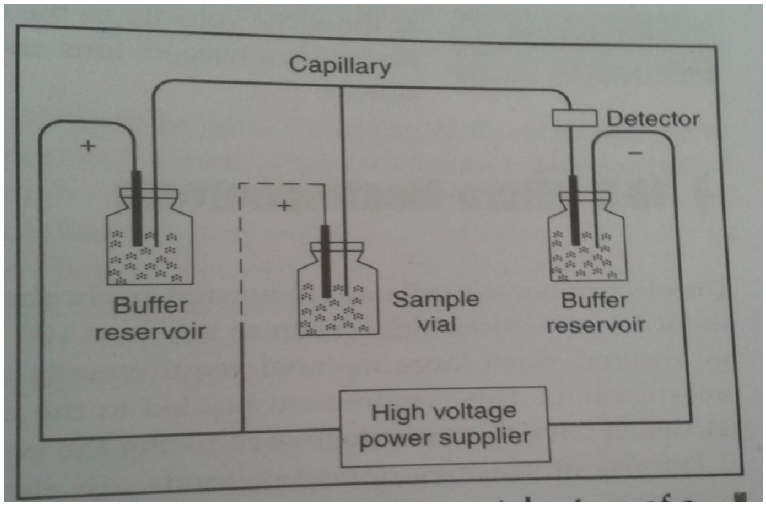


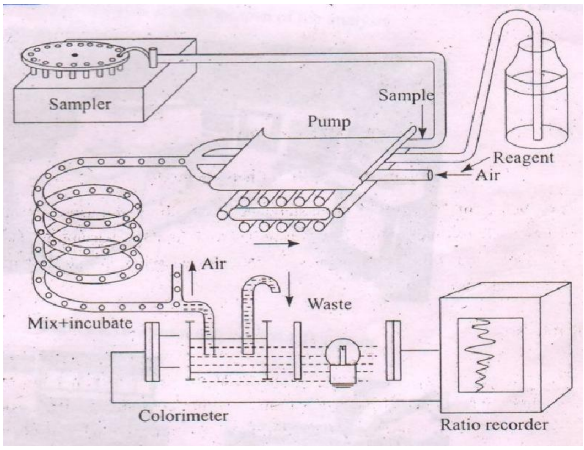
Diagram Capillary electrophoresis

Ans:- (02 Mark)

Fig shows the basic instrumental set of a capillary electrophoresis apparatus .It consist of high voltage power supply (0 to 30KV), a fused silica (s1 o2)capillary ,two buffer reservoirs ,two electrodes ,and an on column detector.Sample injection is done by temporarily replacing one of the buffer reservoirs with a sample vial. A specific amount of sample is introduced by control lining either the injection voltage or the injection pressure. Capillary are typically of 50 micrometer inner diameter and 0.5 to 1 m in length. Capillary electrophoresis uses an electromotive force rather than the pump, to drive the mobile phase through the capillary. Due to electro-osmotic flow, all sample components migrates towards the negative electrode. A small volume of sample (10 nl) is injected at the positive end of the capillary and the separated components are detected near the negative end of the capillary.

Q3Attempt any four. **16 marks**

a) Draw neat diagram of autoanalyzer and describe its working. (2marks+2m)



Block diagram autoanalyzer.

The autoanalyzer sequentially measures blood chemistry and displays this on a graphic readout.

The autoanalyzer includes following elements:

1) Sampler- aspirates samples, standards, and wash solutions to the autoanalyzer system.
2) Proportioning pump and manifold- introduces (mixes) samples with reagents to effect the proper chemical color reaction to be read by the colorimeter. It also pumps fluids at precise flow rates to other modules, as proper color development depends on reaction time and temperature.
3) Dialyzer- separates interfacing substances from the sample material by permitting selective passage of sample components through a semipermeable membrane.
4) Heating bath- heats fluids continuously to exact temperature (typically 37^0C incubation, equivalent to body temperature). Temperature is critical to color development.
5) Colorimeter- monitors the changes in optical density of the fluid stream flowing through a tabular flow cell. Color intensities (optical densities) proportional to substance concentrations are converted to equivalent electrical voltages.

Recorder- converts optical density electrical signal from the colorimeter into a graphic display on a moving chart.

b) List four application of incinerator.(04marks)

Ans. This is mostly used for the purpose of burning biomedical waste like
1. Burning of Placenta
2. Disposable needle syringes
3. Surgical pads

4. Hand glows etc which are used in hospital
5.To burn hygienic waste generated daily may be also saline bottles,dressing cottons & dangerous body parts.etc

c) What is electrophoresis? List different parts of electrophoresis apparatus.(02marks+02m)

Ans. Electrophoresis is a method of analytical chemistry. Basically electrophoresis technique is to separate the molecules based on charge under the influence of an electric field.

Different electrophoresis apparatus :

It contains high voltage power supply (0-30 Kv), buffer, electrodes, detector and a support for the buffer such as filter paper, cellulose acetate strips, polyacrylamide gel, or capillary tubes are used for many types of samples and the other supports are usually used for biological samples such as protein mixtures or DNA fragments. After a separation is completed, the support is stained to visualize the separated components. A complete electrophoresis apparatus comprises:

a. Electrophoresis cabinet,

b. Power supply

c. Densitometer and scanner.

d) State Beer-Lambert's law. List any four analytical instruments based on it.(02marks+02m)

Ans. A combination of the two laws, known jointly as the Beer Lambert law, defines the relationship between absorbance (A) and transmittance (T). It states that the concentration of a substance in solution is directly proportional to the 'absorbance'. A, of the solution.

Absorbance $A = £\, cb$,

Where

A= absorbance (no unit of measurement)

£ = molar absorptivity ($dm^3\ mol^{-1}\ cm^{-1}$)

c= molar concentration ($mol\ dm^{-3}$)

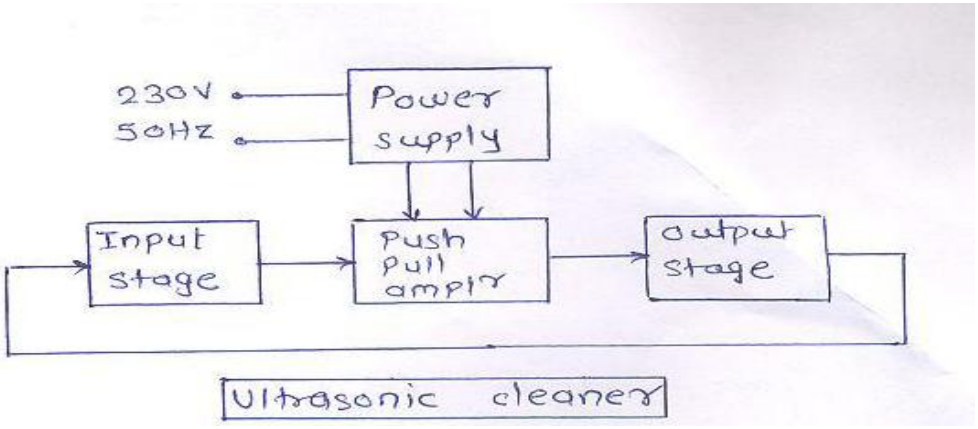
b= path length (cm).

It may be noted that £ is a function of wavelength. so, the Beer Lambert Law is true only for light of a single wavelength or monochromatic light.

Instrument working on above principle :-
01. Spectrophotometers or photometers.
02. Visual colour comparators.
03. colorimeter.
04. single beam spectrophotometer
05. Double beam spectrophotometer.
06. Flame photometer.
07. Single beam colorimeter.
08. Double beam colorimeter

e) Draw neat diagram of ultrasonic cleaner and state its working principle. List any two medical application.(01marks+02m+01m)

Diagram-



Block diagram of ultrasonic Cleaner

Ultrasonic cleaner referred to as sonicator, is a cleaning device that uses ultrasound from (15 to 400 kHz) & appropriate cleaning solution to clean delicate items. The ultrasound is not effective without the cleaning solution. Enhance the effect of a solution for the item to be cleaned & the soiling.

Ultrasonic cleaner produces high frequency waves through water & consequently cavitations process cleans the instruments.

The principle of ultrasonic cleaning process is as follows. Piezoelectric transducer is attached to cleaning tank. They generate ultrasonic waves that vibrate the cleaning fluid at very high velocity creating a process called calibration. Millions of tiny bubbles employed within solution can penetrate into every orifice of the item being cleaned removing dirt within seconds.

Application:

1. Used for cleaning of dental & surgical instruments.
2. Used for cleaning lenses & other optical parts.
3. It can be used in operation theaters, optical & dental clinics, hospitals, laboratories & diagnostic centers.
4. Used for cleaning of jewelry, coins.
5. Used in industries for removing problem contamination.