WINTER– 16 EXAMINATION

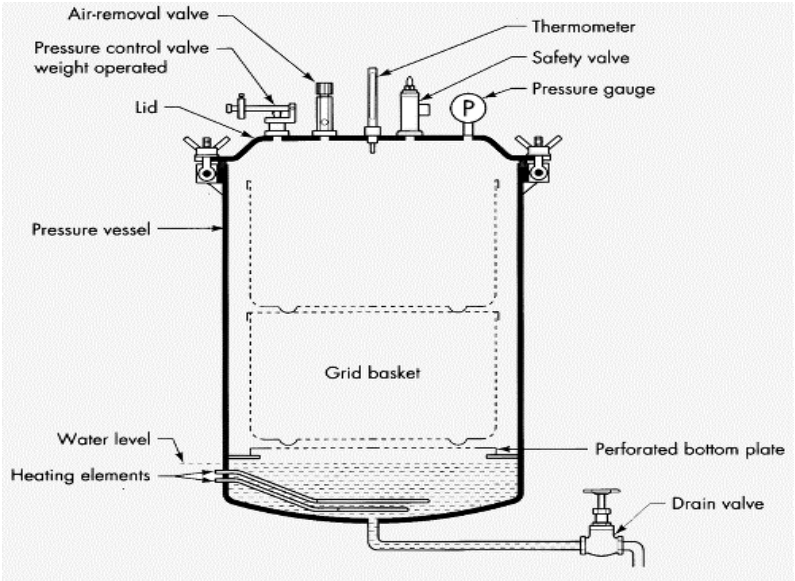
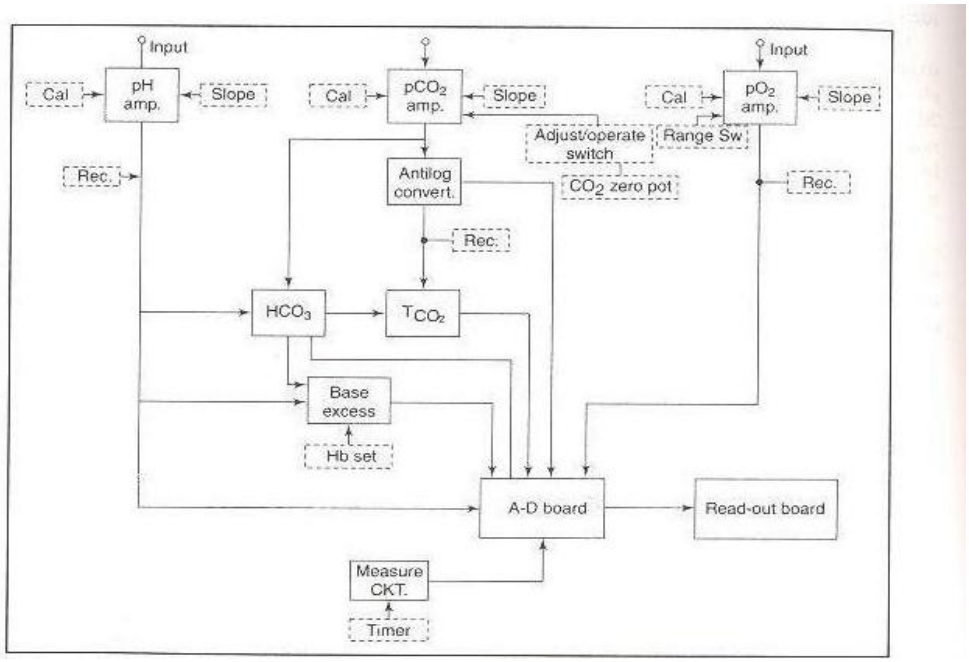
Model Answer

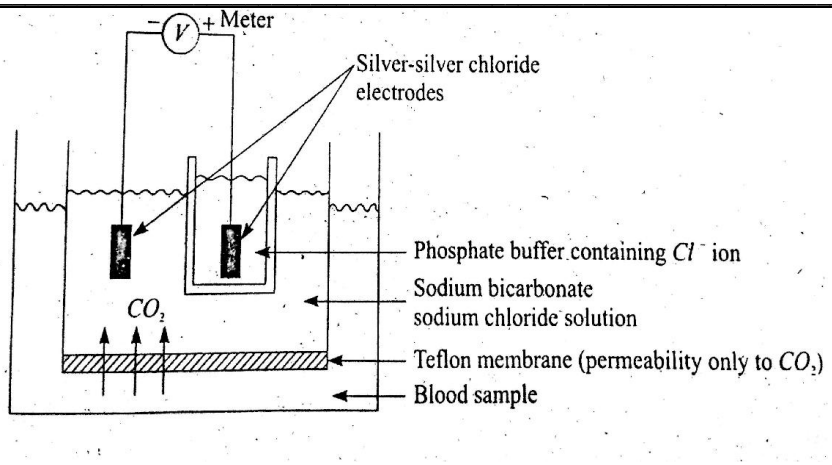
Subject Code: 17544

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. No.	Sub Q.N.	Answer	Marking Scheme
Q1	A)	**Attempt any three**	12
	1)	**State Beer and Lambert Law. List any four analytical instruments based on Beer and Lambert Law.** **Ans:** Beer lamberts law: The amount of energy absorbed or transmitted by a solution is proportional to the solution's molar absorptivity and the concentration of solute. In simple terms, a more concentrated solution absorbs more light than a more dilute solution does. Mathematical statement of Beer's law is $A = \varepsilon lc$, where: A = absorption; ε = molar absorptivity (amount of energy absorbed per moleof substance dissolved), l = path length (the thickness of the solution), and c = concentration of the solution. Equipment based on Beer lamberts law: 1) Colorimeter 2) Spectrophotometer. 3) Flame photometer 4) Glucose meter.	02 02
	2)	**With neat labeled diagram explain the working of autoclave.** **Ans:** Once you close the autoclave sterilizer chamber, a vacuum pump removes all the air from inside the device or it is forced out by pumping in steam. If done the first way, the sterilizer is pumped with high pressured steam to quickly raise the internal temperature. On every autoclave there is a thermometer that is waiting for the thermal sweet point, 268-273 degrees Fahrenheit, and then it starts its timer. During the sterilizing process, steam is continuously entering the autoclave to thoroughly kill all dangerous microorganisms. Once the required time of sterilization has the elapsed, the chamber will be exhausted of pressure and steam allowing the door to open for cooling	

		and drying of the contents.  	**02** **02**
	3)	**Draw neat diagram for computing TCO_2 using blood analyzer.** **Ans**  **OR**	**04**



4) State the types of electronic microscope also list its different parts. — **02**

Ans:

Types of electronic microscope

1. Transmission electron microscope (TEM)
2. Scanning electron microscope (SEM)
3. Reflection electron microscope (REM)
4. Scanning transmission electron microscope (STEM)

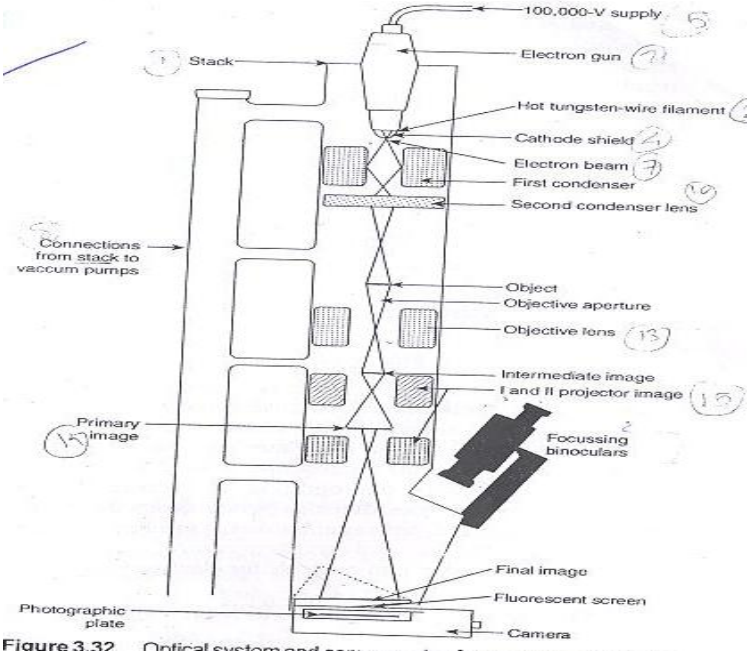
Different parts : — **02**

1. Light Source.
2. Mirror Lenses.
3. Condenser System.
4. Diaphragm.
5. Eye piece.
6. Photomiographic System.

B) Attempt any one. — **06**

1) With neat labeled diagram explain construction and working of transmission Electron Microscope. — **03**

Ans: The uses a high voltage electron beam to create an image the electrons are emitted by on electron gun commonly fitted with a tungsten filament cathode as the electron source. The electron beam is accelerated by an anode at hundred k electron volt with respect to the cathode. It is focused with electrostatic and electromagnetic lenses and it is transmitted through specimen that is in port transparent to electrons and in part scattered then out of the beam. When imerges from the specimen the electron beam carries information about the structure of specimen that is magnified by the objective lens system of the microscope. The variation in the image can be viewed by projecting the magnified electron image on to a florescent screen coated with a phosphor the image can be also recorded with the help of CCD sensor [charge couple devices]

		 Figure 3.32 Optical system and	**03**
	2)	**What is sterilization? Name the analytical equipments that are used for following application and give reason.** **i) For disposal of Biomedical Waste.** **ii) For separation of Blood Content like Plasma, WBC, RBC etc.** **iii) For removing micro duct, clots and blood strain on the instrument.** **Ans:** **Sterilization:** Sterilization is a process in which all the living microorganisms, including bacterial spores are killed. **i) For disposal of Biomedical Waste.** Incinerator is developed which used heat, soit destroys everything (bacteria, u organization). Incinerator is furnace which is constructed used heat resistive material. It has required capacity for burning the material such as 100 kg per 1 hour. **ii) For separation of Blood Content like Plasma, WBC, RBC etc.** A centrifuge is a laboratory device that is used for the separation of fluids, gas, or liquid based on density. Separation is achieved by spinning a vessel containing material at high speed; the centrifugal force pushes heavier materials to the outside of the vessel. 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. **iii) For removing micro duct, clots and blood strain on the instrument.** Hot air oven is used for removing micro duct, clots and blood strain on the instrument. The oven uses dry heat to sterilize articles. Generally, they can be operated from 50 to 300 degC (122 to 572 degF) It is not so damaging to glass and metals equipments as moist heat. The method is suitable for sterilization of assembled equipments such as all glass syringes due to expose to high temperature for a long time.	**06**
Q2		**Attempt any four**	**16**
	1)	**With neat labeled diagram, explain working of capillary electrophoresis.**	

Ans:

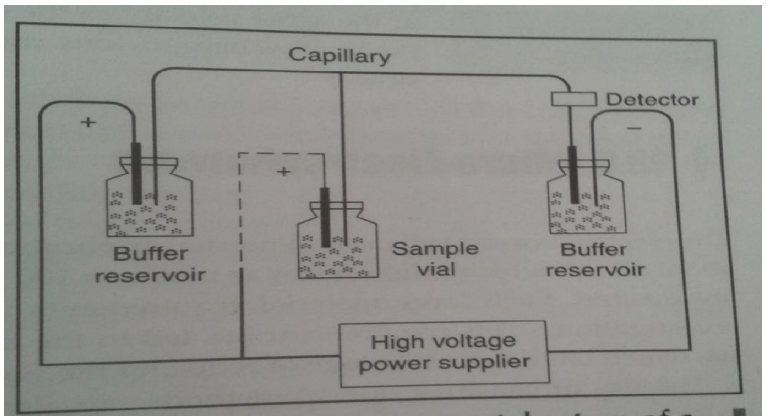


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Fig shows the basic instrumental set of a capillary electrophoresis apparatus. It consists of high voltage power supply (0 to 30KV), a fused silica (s1 o2) capillary, two buffer reservoirs, two electrodes, and an on column detector. Sample injection 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.

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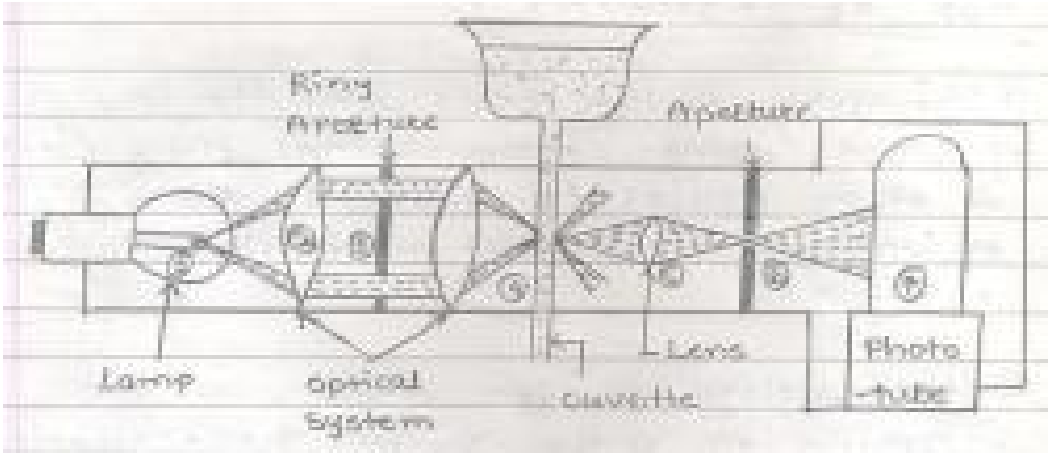
2) With neat labeled diagram, explain working of principle of dark field blood cell counter.

Ans:



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The diluted blood flows through a thin cuvette. The cuvette is illuminated by a cone shaped light beam obtained from a lamp through ring aperture and Optical system. The cuvette is imaged on the cathode of a phototube by means of lens & an aperture. Normally no light. reaches the phototube until a blood cell passes through the cuvette and reflects a flash of light on the phototube.

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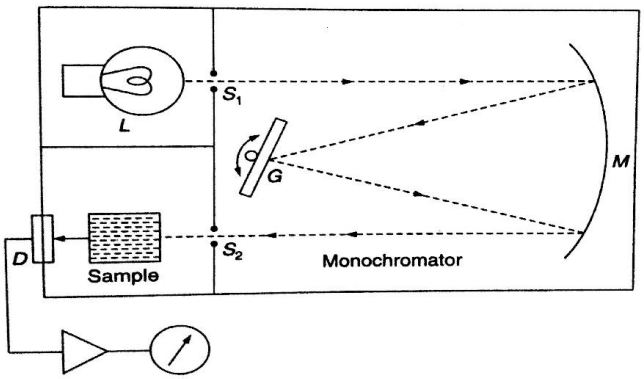
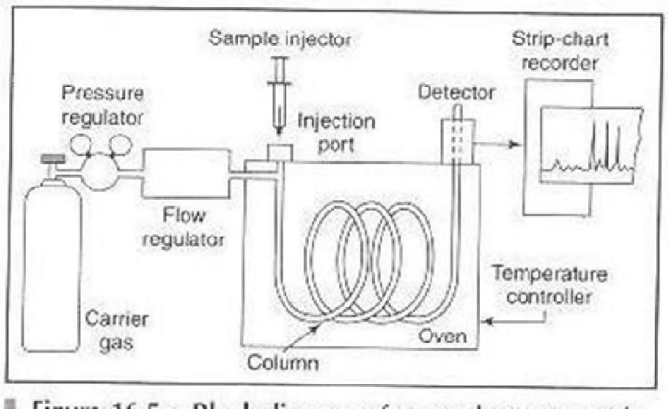
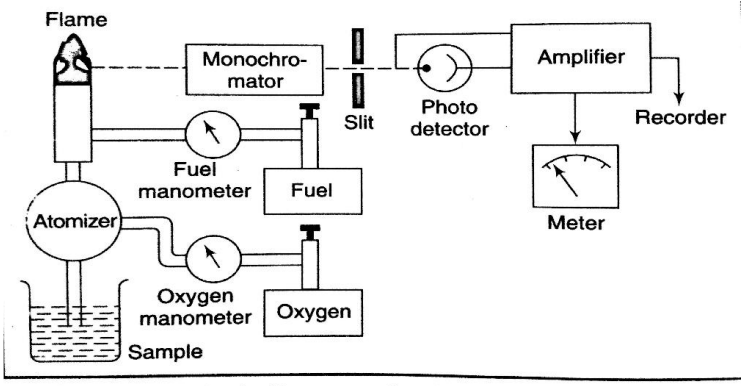
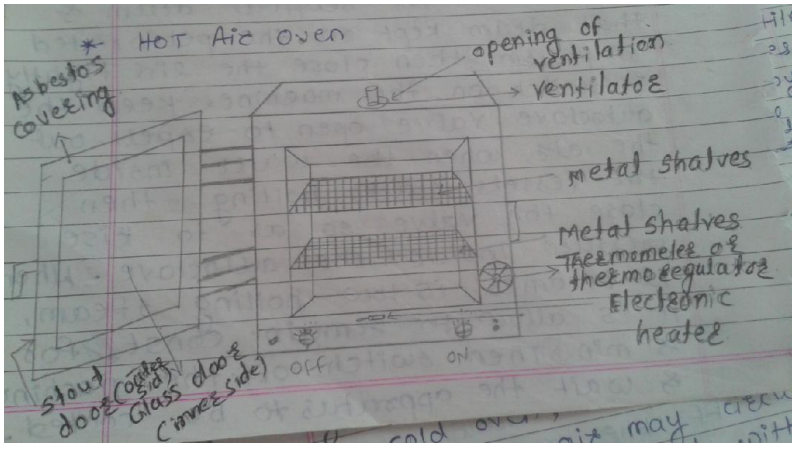
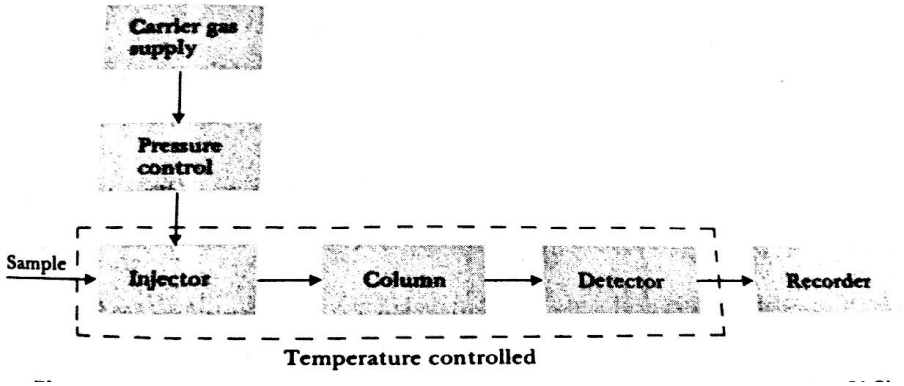
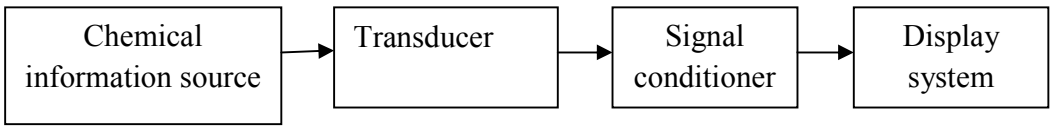
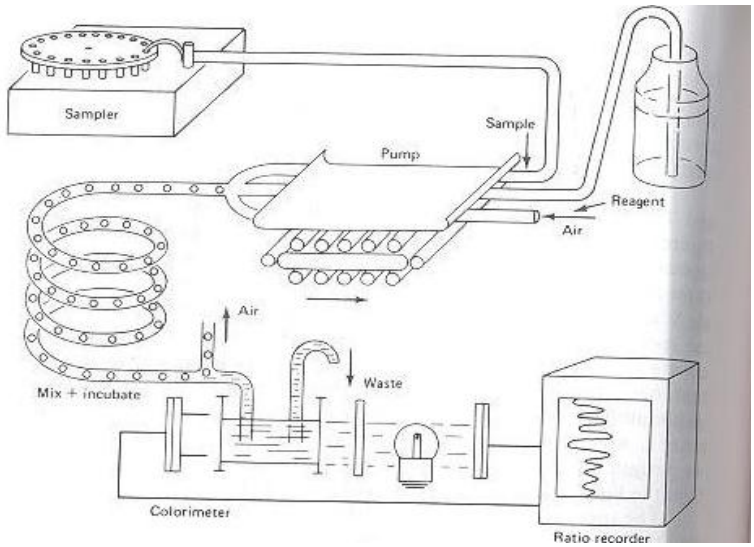
	3)	**Describe the working of single beam spectrophotometer with neat diagram.** **Ans:**  **Figure 10.41** Spectrophotometer. In this instrument, light from a halogen lamp is passed through a slit S_1 and incident on a concave reflector M which focuses the light on a diffracting grating G or on a prism to disperse light. The desirable wavelength from the dispersed light is obtained by taking it at the given direction, and then it is allowed to incident on the reflector. From the reflector, the light is directed through another slit S_2 to the sample. A photodector D detects the transmitted light and gives an electrical output proportional to the intensity of the transmitted light. The amplified signal is given to a voltmeter which is calibrated with respect to the concentration of the substance. The rotation of the grating can be adjusted to measure at different wavelengths.	**02** **02**
	4)	**Write technical specification of blood gas analyzer and blood cell counter.** **Ans:** **Blood gas analyzer:** Throughput: 65 samples / hour. - Sample type: Whole blood, Serum, Plasma. - Sample Application: Sample cup, Capillary or Collection tube. - Storage capacity: 1000 samples. - Power: 110 ~ 230 V AC, 50 / 60 Hz. - Dimensions: 452 (H) x 452 (W) x 500 (D) mm approx. - Equipment weight : 15 Kg. - Operating environment : 15° to 30° **Blood cell counter:** Sample Volume: Vein 20ul Earlobe 10ul Throughput: 60 samples/hour Display: Back-light LCD Data Storage: 1000 sample data with histograms Parameters WBC : Number of white blood cells LYM : Number & rate of lymphocyte MID : Number & rate of mid-range cells GRA : Number & rate of granulocyte RBC : Number of red blood cells HGB : Haemoglobin conc	**02** **02**

		HCT : Hematocrit rate MCV : Mean corpuscular volume MCH : Mean corpuscular hemoglobin MCHC : Mean corpuscular hemoglobin conc. RDW : RBC distribution width PLT : Number of platelet MPV : Mean platelet volume PDW : Platelet distribution width PCT : Plateletcrit value. Power Consumption: 180VA Power Supply: AC 100V/220V ±10%. Dimensions: 330 x 380 x 449 mm. Weight: 19.5 kg Apprx.	
	5)	**Draw the block diagram of gas chromatography and explain its working.** **Ans:**  The basic parts of a gas chromatograph are shown in figure 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	**02** **02**

		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.	
Q3		**Attempt any four**	**16**
	1)	**Describe the working of flame photometry with neat diagram.** **Ans:**  **Figure 4.3 :: Block diagram of a flame photometer** Emission System : It consists of the following : i) Fuel gases and their regulation , comprising the fuel reservoir , compressors , pressure regulators and gauges; ii) Atomizer , consisting ,in turn ,of the sprayer and the atomization chamber, where the aerosol is produced and fed into the flame. iii) Burner ,which receives a mixture of the combustion gases. iv) Flame which is the true source of emission. Optical System : It Consists of the optical system for wavelength selection (filters or monochromators), lenses ,daiphragms , slits , etc.	**02** **02**
	2)	**Explain the working of hot air oven with neat diagram.** **Ans:**  **Construction**:- Double walled, the motor fixed at the back / triple walled, ducted air flow type, the	**02**

		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	**02**
	3)	**Explain liquid chromatography with neat diagram.** **Ans:**  **OR** **ANY OTHER RELEVANT DIAGRAM** The basic component of liquid chromatography as shown in fig. The function of the major subsystem are as follows: **Injector:** The injector is used to introduce into liquid chromatography 1-5 ml of the patient sample including the solvent in which is contained (usually a volatile organic solvent). The temperature of the injector is set to flash – evaporate the sample and solvent **Carrier Gas:** The insert carrier gas (usually N2 or He) is the mobile phase of the chromatograph. It sweeps the evaporated sample and solvent gas down the column. **Column:** The column typically is 1 m long and less than 7 mm in diameter. It is packed with the solid support material (such as diatomaceous earth). The solid support is coated with the liquid phase .The small size of the solid beads produces the separation of the component. The column is enclosed in an oven the temperature of which is carefully controlled. A temperature programmer gradually increases the temperature of the column in a sequence designed for maximal efficiency of separation for the type of substance being analyzed. **Detector:** The detector is located at the end of the column. Its function is to provide an electric output proportional to the quantity of the compound in the effluent gas. A number of types of detectors are available for use with different type of samples. They include ionization detectors, thermal- conductivity detectors, and electron-capture detectors. Ionization detectors are most commonly used in clinical laboratory application.	**02** **02**

		Recorder: In the recorder, the x axies represents time, and the y axis the output of the detector. The recording thus provides a display of both the quantity of a component that was present and the time at which it was eluted off the column. From this information, the component present can be identified by the time they took to leave the column.	
	4)	**Draw and explain block diagram of analytical instrument.** **Ans:**  **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. It also increases sensitivity of instrument by amplification of original signal. **4) Display System**: It provides a visible presentation of quantity as a displacement of scale or chart or record.	**02** **02**
	5)	**With neat diagram explain construction of auto analyzer.** **Ans:**  Working: Working/Operation:- 1) Sampler:- It fits the sample into analyzer in a particular time sequence. 2) Proper pump:-It is basically a simple peristaltic pump working simultaneously on a number of with certain ratio of diameter is used to meter the sample & regent. 3) Mixing: - mixing is achieved by injecting air bubbles the mixture is incubated while flowing through heated coils. The air bubbles are removed & the solution finally throws the Cavite of colorimeter or is aspired in to flame photometer. 4) Recorder:- An electronic ratio recorder compares the output the reference &	**02**

		sample photocell. The recording shows the individual samples as peak s of a continuous transmittance or absorbance recording. T The samples of a "run" are preceded by a number of standards that cover the useful concentration range of the test. The concentration of the samples is determined from the recording by comparing the peak o f the samples with the peaks of the standards. n this way the effects of errors are eliminated because they affect standards and samples in the same way. The smallest models of the Auto analyzer perform a single test at a rate up to 120 samples per hour. Large later models performs u[12 different tests on each of 90 samples per hour.	**02**