

A Laboratory Manual for
Maintenance of Electronics
Equipment and EDA Tools
Practices
(22036)
Semester- IV
Diploma in Electronics & Telecommunication
Engineering
(EJ)



Bharati Vidyapeeth's Institute of Technology

Navi Mumbai

Certificate

This is to certify that, Mr./ Ms.

Roll No. of Forth Semester of Diploma in Electronics & Telecommunication Engineering of Bharati Vidyapeeth's Institute of Technology Navi Mumbai (Inst.code:) has satisfactorily completed the term work in the subject Maintenance of Electronics Equipment & EDA Tools Practices (22036) for the academic year 20.... to 20.... as prescribed in the MSBTE curriculum.

Place: Enrollment No. :

Date:..... Exam. Seat No. :

Subject Teacher

Head of the Department

Principal



Table of Contents

Sr. No.	Title	Date of performance	Date of submission	Marks	Sign of teacher
1	Prepare the work order for the maintenance of the given equipment.				
2	Prepare bin card for the maintenance of given equipment.				
3	Install closed circuit television.				
4	Install online/offline UPS.				
5	Test performance of the given(Fractional horse power) DC motors.				
6	Test performance of the Given Stepper motor.				
7	Identify/test various Ics (analog & Digital) using IC tester.				
8	Troubleshoot the data projector.				
9	Troubleshoot the circuit breaker (MCB & ELCB).				
10	Install DTH receiver (indoor & outdoor unit).				
11	Troubleshoot the regulated power supply circuit of given equipment.				
12	Troubleshoot the given mixer/grinder with fractional horse power.				
13	Assemble the various parts of the computer system and install operating system, application software & antivirus on a computer.				
14	Troubleshoot the domestic water level controller.				
15	Troubleshoot the electronic weighing machine.				

16	Troubleshoot the Emergency light system.				
17	Troubleshoot the photovoltaic solar panel power system.				
18	Create new file using given EDA tool to develop the layout of the regulated power supply circuit.				
19	Measure dc current and dc voltage of the given circuit using node analysis through EDA simulation tool.				
20	Simulate/Test half wave rectifier circuit using EDA simulation tool.				
21	Use EDA tool to draw & simulate schematic circuit of full wave rectifier.				
22	Use EDA tool to draw & simulate two stage RC coupled/transformer coupled /DC coupled Amplifier				
23	Use EDA tool to draw & simulate given circuit of inverting /non-inverting amplifier.(IC-741)				
24	Use EDA tool to draw & simulate 3 bit adder to match truth table				
25	Use EDA tool to draw & simulate BCD to 7 segment decoder.				

Name and Signature of student

Name and Signature of staff

Experiment no. 1

Title: Prepare the work order for the maintenance of the given equipment

What is a Work Order?

A work order is an authorization of maintenance, repair or operations work to be completed. Work orders can be manually generated through a work request submitted by a staff member, client, tenant, or automatically generated through a work order management software or Preventive Maintenance (PM) schedule. Work Orders can also be generated via follow ups to Inspections or Audits.

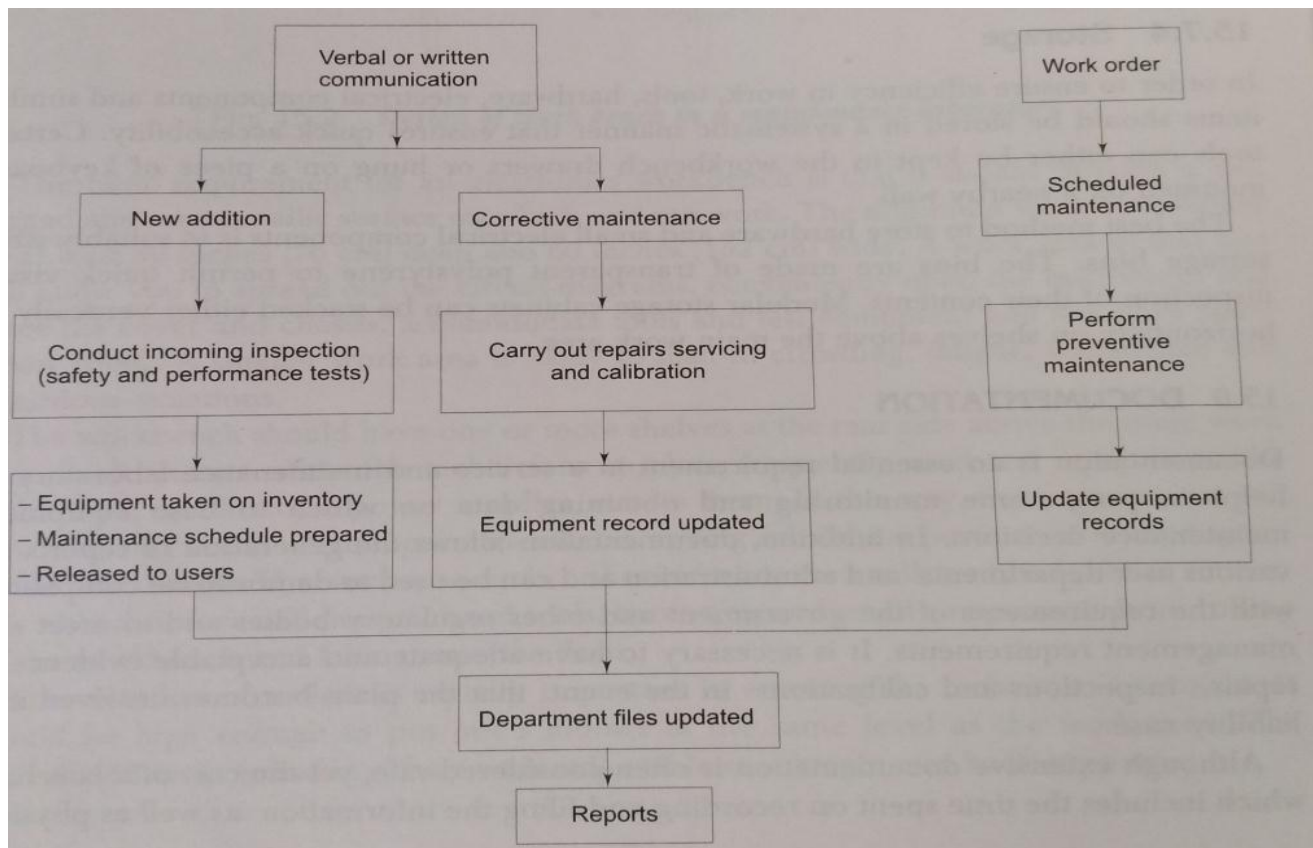


Fig-Maintenance system overview

What is the purpose of generating a work order?

- Offer an explanation of the problem, repair or installation
- Schedule resources and tools needed for maintenance
- Provide technicians with detailed instructions on the work to be performed
- Document the labor, materials and resources used to complete the work
- Track all maintenance and repair work that has been performed on each asset

What are work orders comprised of?

- Who is requesting the work
- Who is authorizing the work
- Who will perform the labor
- What the task at hand is
- When the work needs to be completed by
- Where the work needs to be performed.

How to complete the tasks, with necessary parts listed Work Order Request Management

Work cannot always be planned ahead of time. For corrective work or customer appeals, work order requests are submitted. Maintenance managers can tailor workflow processes for request submission, approval, rejection, and completion to the specific needs of their organization. Identifying a workflow process ensures:

- Standard Operating Procedures (SOPs) are adhered to by all users
- Work goes through an approval process
- Areas of responsibility and expectations are clear for users
- Periodic process auditing is performed
- Valid data is being entered into a CMMS
- Efficient communication flow.

Using Your CMMS for Work Order Management

Work orders are the heart of a maintenance program, and utilizing the work order software tools within a CMMS helps organizations stay up-to-date on labor, projects and resources in the current queue. The work order management tools enable an organization to take control of work backlog and upcoming work, make constant improvements, boost labor productivity and remain compliant. There are three main players in the work order management process:

1. Work Requestor -


Creates work requests to report an issues on equipment or assets.

2. Work Order Approver-

Approves request & assigns work to appropriate technicians.

3. Technician-

Performs work & closes work order

 **Form Design** **Design of PM Work Order**

WO# Code:

Tech Name: Employee no: Eq Number :
Date : Shift no : Eq Name :
Required man/hr: Plant/factory no :
Cost Center :

Safety Considerations:

Estimated required time for each PM Interval:
Weekly----- Semi Anually-----
Monthly----- Anually-----
Quarterly-----

Allowed time: (to be filled by the supervisor): Actual time: (to be filled by
technician):

Estimated Labor number :

Prepare the work order for Equipment:-

mentioned require-

WORK ORDER

Sr. No. _____

Request received from _____ Date _____

Tele No. _____ Fax No. _____ Deptt. _____

_____ e-mail _____

Name of the Equipment _____

Manufacturer _____

Model No. _____

Accessories Received _____ Sr. No. _____

Defects Reported _____

Work allotted to _____ Signature of Supervisor _____

Progress of Work

Name of the Engineer/ Technician	Dates		Cost Estimates
	From	To	

Parts Used

Sr. No.	Name of the Parts used	Cost

Total Cost _____

Work completed on _____

Conclusion:-

Questions:-

1. What is work order?
2. Write the purpose of generating work order.
3. Write the steps of work order management.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no. 2

Title: Prepare Bin Card for the maintenance of given equipment.

Theory:

What is a BIN CARD?

A BIN Card is a table that records the status of a good held in stock. A typical retailing business with a large stock warehouse will use a BIN Card to record a running balance of stock on hand, in addition to information about stock received and notes about problems associated with that stock item.

What does BIN in BIN Card stand for?

BIN stands for Business Identification Number

Often, a Stock BIN Card is compared with a stock register or store ledger and usually, regularly updating and maintaining the store ledger can be sufficient. A BIN card however always need to be kept up-to-date by putting in the transactions before these actually have taken place. A bin card is a handy record for an online or offline storekeeper whereas a ledger is for the finance and costing department.

This BIN card format template is a printing and keeping once a week or once a new hardcopy BIN card inside the store, most columns within this BIN Card format will be left empty before a storekeeper writes down exactly the transactions on the hardcopy form.

When do I need this BIN Card Format template?

Download this BIN Card template when you are a storekeeper, looking for a solution to keep track of the transactions that are taking place. You can use this ready-made template easily to create and implement your personal BIN Card system.

However, in some cases, storekeepers are provided with a store ledger in lieu of a BIN card. This is not a common, and not according to the basic principles of stock keeping and business accounting, simply because a store ledger also contains information about the up-to-date value of the goods in stock. The BIN Card is more focused on solely keeping insight in the quantity.

BIN CARD FORMAT

A BIN CARD is a document that records the status of a good held in stock. A typical retailing business with a large stock warehouse will use a BIN card to record a running balance of stock on hand, in addition to information about stock received and notes about problems associated with that stock item.

Business Division :
 Business Department :
 Business Item Name :
 Business Item Code :

No	Date	In	Out	Balance	Notes	Sign

This BIN Card is updated on:

NOTICE ALLBUSINESSTEMPLATES.COM

The information in this document is designed to provide an outline that you can follow when formulating business or personal plans.

Due to the variances of many local, city, county and state laws, we recommend to consider professional legal counseling before entering into any contract or agreement. AllBusinessTemplates.com herewith expressly rejects any liability incurred due to the use of any documents provided on its website.

<u>Bin Card</u>						
Material Code:			Maximum Level:			
Material Description:			Minimum Level:			
Location:			Reorder Level:			
Unit of Measurement:						
Date	Doc No.	Received from/Issued to	Receipt	Issue	Balance	Verification with SL Date & Verified by

What does the BIN Card template cover?

This BIN Card template consists of the following components.

- business identifying the store's location and other characteristics;
- identifying stock information such as business identification name or business identification number;
- a matrix where you can keep track of incoming and outgoing stock and it's balanced.

Conclusion:-

Questions:-

1. What is BIN CARD?
2. State the need of BIN CARD.
3. What does the BIN Card template cover?
4. Prepare bin card for any electronic Equipment available in laboratory.
5. What does the BIN Card template cover?

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no. 3

Title: Install closed circuit television (CCTV).

Apparatus:

1. IR dome camera.
2. 4CH DVR .
3. Hard disk 500GB.
4. Video cable .
5. Power supply(12V,1A)

Theory:

What is CCTV? :-

Closed-circuit television (CCTV), also known as video surveillance, is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. It differs from broadcast television in that the signal is not openly transmitted, though it may employ point to point (P2P), point to multipoint (P2MP), or mesh wired or wireless links. Though almost all video cameras fit this definition, the term is most often applied to those used for surveillance in areas that may need monitoring such as banks, stores, and other areas where security is needed.

Closed Circuit Television (CCTV) is a system where the circuit in which the video is transmitted is closed and all the elements (camera, display monitors, recording devices) are directly connected. This is unlike broadcast television where any receiver that is correctly tuned can pick up and display or store the signal. Such specialized systems are not subject to regulation by the Federal Communications Commission (FCC); however, security cameras using scrambled radio waves are in fact subject to common carrier tariffs and FCC conditions of service. In the past, these signals would be transmitted to a monitor equipped with a videocassette recorder, but these have been all but totally replaced by digital video recorder (DVR) systems that can store far more video and backup data automatically.

Other Uses of CCTV

CCTV has become ubiquitous in large cities, along major highways, and areas that host large events. On streets and roads, CCTV is often used in traffic law enforcement, but it's used to monitor traffic patterns, allowing emergency services to react quickly to accidents and for maintenance departments to better plan necessary construction projects. In hotels, stadiums, and convention centers, CCTV is often used in private television networks, broadcasting sporting events or special events throughout their facilities.

Types of CCTV cameras:- Any camera that broadcasts a signal can be attached to a CCTV system, whether it's wired or wireless, but they are most often associated with high-end surveillance cameras. Pan/tilt/zoom (PTZ) cameras allow a user to remotely control a camera.

- Dome CCTV Camera.
- Bullet CCTV Camera.
- C-Mount CCTV Camera.
- Day/Night CCTV Camera.
- Infrared/Night Vision CCTV Camera.
- Network/IP CCTV Camera.
- Wireless CCTV Camera.
- High-Definition HD CCTV Camera.

Surveillance Security Camera



Professional Box Camera



Dome Style Camera



Bullet Style Camera



P/T/Z Camera



Network Camera



Hidden Camera

Types of CCTV cables.

- Analog CCTV Cameras
 1. Premade Siamese Cable for lengths up to 150ft.
 2. RG59 Siamese Cable Spool for lengths up to 400ft.
 3. RG59 Solid Copper Siamese Cable Spool for lengths up to 1000ft.
 4. CAT5e or CAT6 wire for runs up to 1000ft using passive video baluns.
 5. CAT5e or CAT6 wire for runs up to 3000ft using active video baluns.
- HDCVI Cameras

1. RG59 Siamese Cable Spool for lengths up to 240ft.
 2. RG59 Solid Copper Siamese Cable Spool for lengths up to 1600ft.
- IP Cameras
 3. CAT5e or CAT6 Network Cabling for runs up to 328ft for non-POE cameras.



Steps for install CCTV :-

1. Planning before installing a CCTV camera:-

The most important aspect of installing a CCTV camera system is choosing the right spots for camera and DVR to maximize camera coverage and minimize cable length (which in-turn reduces the in line losses that affect video quality). For indoors, choose a corner in the room from where most entry points into the room are visible. A power socket should also be in close proximity. For outdoors, choose a higher spot covering the door, window approaches, garages etc. Choose the spots above 10ft so that it cannot be knocked down easily.

2. Mounting the camera :-

Place the camera unit at the desired place, make guide marks for drilling. Drill holes and hammer in the screw mouldings. Now, screw the camera in place firmly. Insert the power cable of the camera in a socket.

3. Placing the DVR:-

DVR of the CCTV is the place where the surveillance hard disk is present. Thus all your CCTV recording reside inside a DVR. It is highly recommended to keep the DVR inside a locked compartment so that even if an intruder spots the DVR, he/she can't destroy the recorded videos. This is a vital step to ensure a bullet proof security system for your home

4. Managing the cables:-

Plan the pathway for all the cables from cameras to DVR unit. Use wire moldings to keep the wire managed and safe. Nail the moldings along the path and put the Siamese surveillance wire inside.

5 Connecting the wires:-

The video cable is connected via a BNC port. Remove about 1.5cm of outer covering of the video cable which should now expose the braids. Slide the crimping barrel onto the cable with wider diameter facing towards the end of the cable. Now remove the white insulator covering the innermost cable. Now insert these exposed cables into the BNC port and screw the crimping barrel. This makes a secure connection. Connect the DVR output port to the screen on which you want the video feed.

6. Power on the system:-

Start by powering ON the cameras followed by the display and the DVR. Setup the DVR according to the user manual provided with the DVR. Go over every camera's feed to confirm each camera is working properly and providing the desired viewing angle.

Conclusion:-

Questions.

1. What is CCTV?
2. Write advantages of CCTV.
3. State the Types of CCTV cameras.
4. State different applications of CCTV.
5. Find out cost of CCTV cameras related for different applications.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no.4

Title: Install ONLINE/OFFLINE UPS.

Apparatus:

1. UPS setup box.
2. Connecting cables.
3. Multimeters

Theory:

Uninterruptable Power Supply (UPS):-

UPS is the abbreviation for Uninterruptible Power Supply, and is a device which supplies power to devices for a fixed amount of time without stopping even when there are problems occurring with utility power and other power sources. In this present-day highly information-orientated society, the work tasks of many industries, including manufacturing, service and medical, operate on networks. For this reason, network system stoppages have an enormous impact on society and as such, the importance of UPS to provide these systems with a stable power supply is increasing.

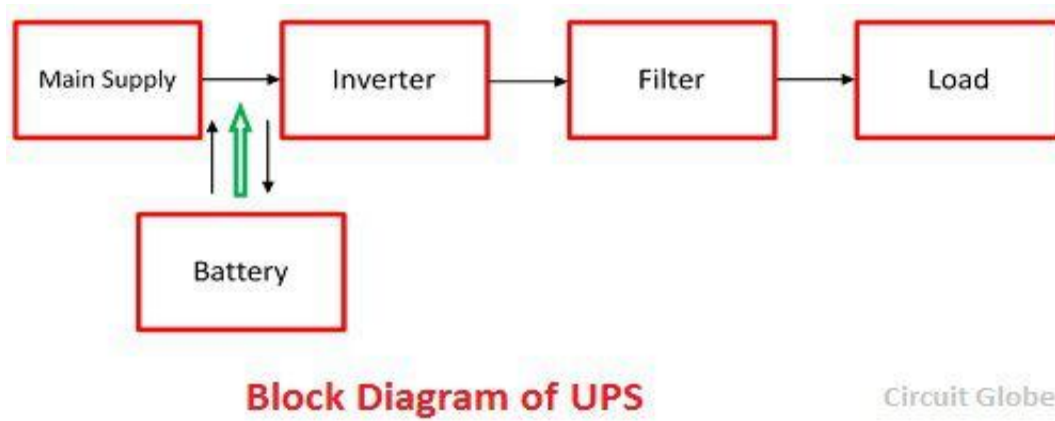
Due to power outages, the first UPS was built in the 1960's to protect sensitive equipment. This first unit had 4 important components. A Battery, Inverter, Charger and a Transfer switch. Today these 4 components are still the main building blocks of any UPS. The boost in the computer industry enhanced sales of UPS's. This led to the development of highly complex systems which enhances the protection, supervisory circuits, self-checking and communication functions.

UPS stands for Uninterruptible Power Supply. It is an instrument connected between the electric grid (ESCOM) and the consumer (computer). It comprises of electric hardware and rechargeable batteries.

The aim of the instrument is to supply continuous undisturbed and conditioned power to the critical load. The energy for powering the load comes from the utility, or from the battery upon mains outage.

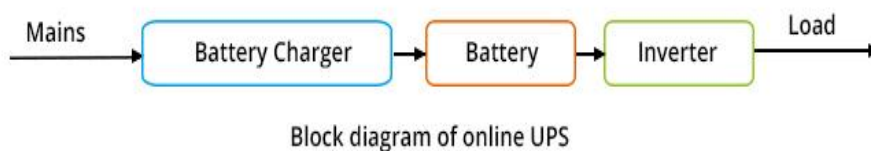
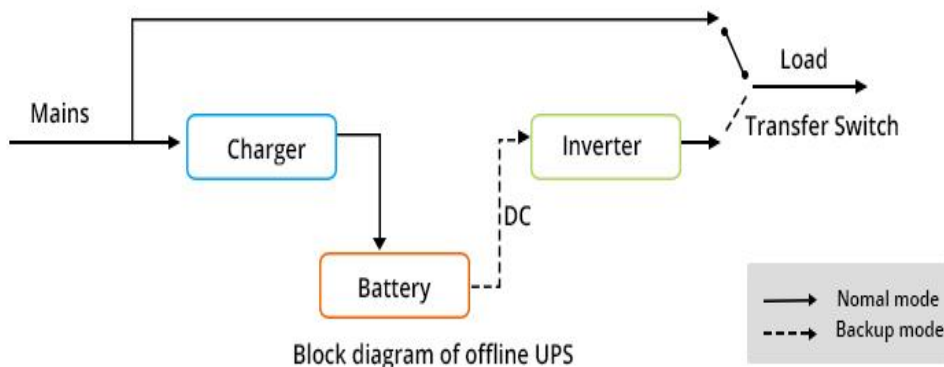
Basic structure :-

UPS consists of the following circuits and the battery. In the event of a power outage or failure occurring in the AC input, the UPS continues supplying power from the batteries to the AC output.



- (1) **Rectifier:** Circuit which converts AC power to DC power.
- (2) **Inverter:** Circuit which converts DC power to AC power.
- (3) **Bypass:** Circuit which directly outputs AC power.
- (4) **Switch:** Circuit which switches between inverter output and bypass output.

Online /offline UPS:-



Offline UPS's are the simplest and least expensive. When mains is present, it is routed straight through the UPS bypassing the inverter to the output. A degree of filtering is providing ensuring limited protection against spikes and other irregularities. The batteries are charged the whole time, but only in the event of a power failure will the load be fed by the inverter. The switching from mains to inverter supply (generally referred to as Transfer Time) usually takes a few milliseconds.

However, a modern computer's or office system's internal power supply has sufficient power stored within it to survive this brief interruption of power – ensuring uninterrupted operation of the load equipment.

Online UPS's take the incoming AC mains supply and convert it to DC which feeds the battery and the load via the inverter. If the mains supply fails, then the batteries feed the load via the inverter with no interruption to the output supply at all. An Online system, by nature of the dual conversion design (AC-DC / DC- AC), ensures a far higher degree of isolation of the load from the irregularities on the mains supply. In general, Plug N Play Online systems are more expensive than similar Offline solutions because the inverter has to be rated for continuous operation.

Steps for Installation of UPS :-

1. **CHOOSING THE RIGHT COMPANY:** There are several factors to consider when it comes to commissioning a new UPS unit. However, the most important decision you can make is partnering with a true consultative resource that makes a concerted effort to guide you through the entire decision making process.

2. DECIDING WHICH UPS IS RIGHT FOR YOU:

- What exactly will the UPS be protecting? Servers, medical equipment, manufacturing equipment, telephony, etc? It's important to first understand what your needs are before deciding what UPS is best for your specific needs.
- What is your runtime requirement?
- Will your organization experience load growth or significant reduction in the next few years?

3. INSTALLING THE UPS SYSTEM:-

PRE-INSTALLATION: Before the installing occurs, an extensive Site Survey may need to be performed. It is imperative to select the best location and design for your UPS system prior to install.

COMMISSIONING: Once the UPS system has been selected, the real work begins. Proper project management and commissioning is key to a successful installation. During a new or replacement project, ensuring that all the appropriate stakeholders are involved is crucial.

POST-INSTALLATION: Most UPS systems come with a limited factory warranty, however most warranties do not include routine PM inspections. It is imperative to have a plan for service during warranty and once that warranty expires. Similar to a car's engine, a UPS system needs regular maintenance at regular intervals. Proper preventative maintenance along with replacing batteries, capacitors and fans is a crucial step to protecting your investment.

Troubleshooting of UPS:-

problem	Possible Cause	Solution
The UPS will not turn on or there is no output	The unit has not been turned on.	Press the ON button once to turn on the UPS. Please note that the LCD screen may be lit even though the UPS is OFF.
	The UPS is not connected to utility power.	Be sure that the power cable is securely connected to the unit and to the utility power supply.
	The input circuit breaker has tripped.	Reduce the load to the UPS, disconnect nonessential equipment and reset the circuit breaker.
	The unit shows very low or no input utility voltage	Check the utility power supply to the UPS by plugging in a table lamp. If the light is very dim, check the utility voltage.
	The battery connector plug is not securely connected.	Be sure that all battery connections are secure.
	There is an internal UPS fault.	Do not attempt to use the UPS. Unplug the UPS and have it serviced immediately
The UPS is operating on battery, while connected to utility power	The input circuit breaker has tripped.	Reduce the load to the UPS, disconnect nonessential equipment and reset the circuit breaker.
	There is very high, very low, or distorted input line voltage.	Move the UPS to a different outlet on a different circuit. Test the input voltage with the utility voltage display. If acceptable to the connected equipment, reduce the UPS sensitivity.
UPS is beeping	The UPS is in normal operation.	The UPS display will indicate the current operating mode that is causing the beeping. (On battery, replace battery, etc..)
UPS does not provide expected backup time	The UPS battery is weak due to a recent outage or is near the end of its service life.	Charge the battery. Batteries require recharging after extended outages and wear out faster when put into service often or when operated at elevated temperatures. If the battery is near the end of its service life, consider replacing the battery even if the replace battery indicator is not yet illuminated.
	The UPS is overloaded.	Check the UPS load display. Unplug unnecessary equipment, such as printers
Display interface LEDs flash sequentially	The UPS has been shut down remotely through software or an optional accessory card.	None. The UPS will restart automatically when utility power is restored.
Fault LED illuminates	Possible Internal Fault	Contact APC Support for further assistance. Take care to note the exact fault message on the LCD Display
All LEDs are illuminated and the UPS is plugged into a wall outlet	The UPS has shut down and the battery has discharged from an extended outage.	None. The UPS will return to normal operation when the power is restored and the battery has a sufficient charge.

The Replace Battery LED is illuminated	The battery has a weak charge	Allow the battery to recharge for at least four hours. Then, perform a self-test. If the problem persists after recharging, replace the battery
	The replacement battery is not properly connected.	Be sure that the battery connector is securely connected.
The UPS displays a site wiring fault message	Wiring faults detected include missing ground, hot-neutral, polarity reversal, and overloaded neutral circuit.	If the UPS indicates a site wiring fault, have a qualified electrician inspect the building wiring. (Applicable for 120 V units only.)

UPS observation table:-

Input voltage	
DC BUS Voltage	
Inverter output Voltage	
Grid Frequency	
Switching Frequency	
Output frequency	
Output power factor	
No. of batteries	

Conclusion:

Questions.

1. What is UPS? And state its need
2. What are the Basic components of UPS?
3. What are the types of UPS?
4. Write the various applications of UPS.
5. Write the function of inverter in UPS.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no. 5

Title: Test performance of given (Fractional Horse power) DC motor.

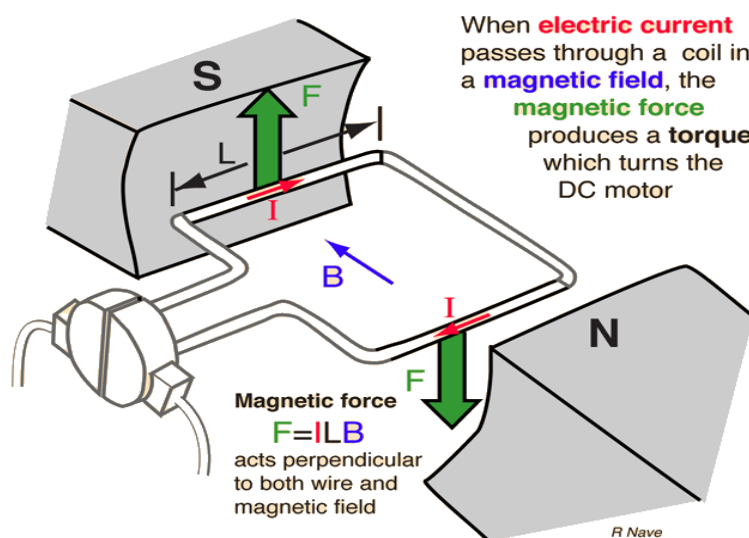
Apparatus:

1. DC shunt motor with starter and brake with spring balance arrangement.
2. Voltmeters and Ammeters
3. Rheostat
4. Connecting wires.
5. Tachometer

Theory:

DC motor working principle:-

- An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force.



Types of DC Motors

DC motors are usually classified on the basis of their excitation configuration, as follows -

- Separately excited (field winding is fed by external source)
- Self excited -
 - Series wound (field winding is connected in series with the armature)
 - Shunt wound (field winding is connected in parallel with the armature)

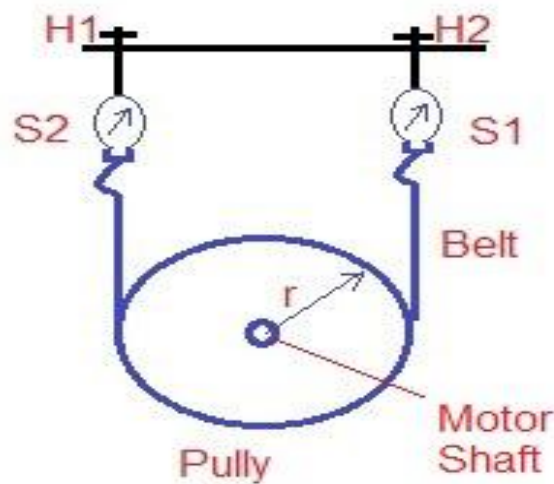
- Compound wound -
 - Long shunt
 - Short shunt.

Testing of DC shunt motor:-

- DC Machines can be tested by three different methods namely Direct Method, Indirect Method and Regenerative Method. Direct Method of testing of DC Machine, also known as Brake Test.

Direct method (Brake Test):-

- It is a direct testing method in which motor is loaded by applying load on the mechanically coupled brake drum. It consists of mechanically coupled brake drum (pulley and belt arrangement) with spring balances on both sides. By adjusting spring tension, motor can be loaded from no load to full load.

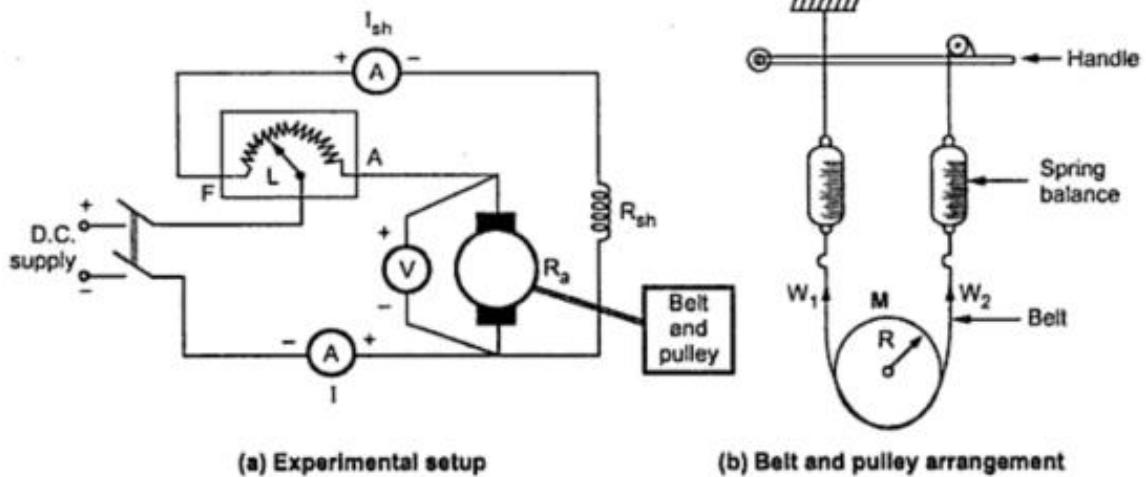


- In Direct Method, the DC machine is subjected to rated load and the entire output power is wasted. The ratio of output power to the input power gives the Efficiency of DC Machine.

Name plate Details of DC machine:-

1. Name of Manufacturer -----
2. Type of machine -----
3. Voltage -----Volts 4. Currents -----Amps
5. Power -----Kw/HP 6. Speed ----- Rpm

Circuit Diagram:-



Stepwise Procedure:-

1. The connections are made as per the circuit diagram.
2. Initially the starter is in off position.
3. The field rheostat is in minimum position.
3. 220 DC supply is applied by closing the DPST Switch.
4. The DC motor is started slowly with the starter and brought to the rated speed.
5. Load is applied on the drum gradually in steps by tightening the belt around it.
6. The readings of the ammeter & voltmeter, two spring balances and the speed at every Step are noted.
7. Drum is cooled throughout the loading period by pouring water.
8. The experiment is continued till the full load on the motor is impressed.
9. The machine is switched off by opening the DPST switch.

Observations:-

- Radius of pulley (brake drum) $r = \text{-----m}$
- Effective Radius of pulley $r_e = r + t/2 = \text{-----m}$

Where $t = \text{thickness of the belt in meter.}$

Sr.No.	V(volts)	I(Amp)	Motor I/P=VI(Watts)	W1 kg	W2 kg	Speed N rpm	Torque(T)=9.81 * r_e *(W1-W2) N.m
1							
2							
3							

4							
5							

Sample Calculations:-

- Reading of 1st spring balance W_1 = -----kg
- Reading of 1st spring balance W_1 = -----kg
- Torque $T = 9.81 * (W_1 - W_2) * r_e$ = ----- = -----N.m.

Result :-

- At full load torque of dc shunt motor = -----N.m.

Graph:- plot graph of speed Vs Torque.

Conclusion:-

Questions.

1. State working principle of DC motor.
2. Why brake test is performed only on small DC machine?
3. State different types of DC motor
4. Compare DC series and DC shunt motor.
5. Write various applications of DC motor
6. State the various losses in DC motor.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No: 6

Title:- Test the performance of given stepper motor.

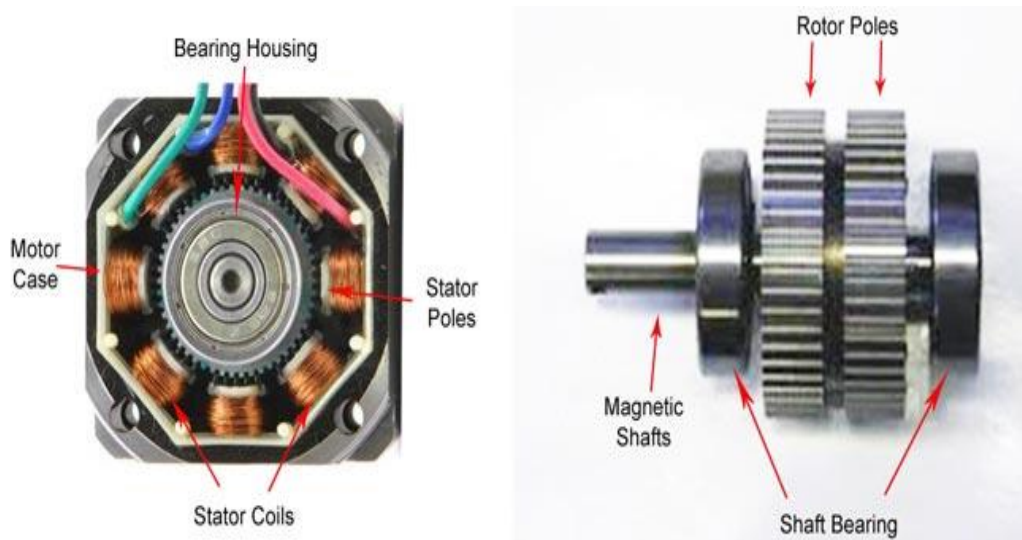
Apparatus:

1. Stepper motor
2. Stepper motor drive circuit.
3. Power supply

Theory :

What is Stepper motor?

- A stepper motor is an electromechanical device it converts electrical power into mechanical power. Also it is a brushless, synchronous electric motor that can divide a full rotation into an expansive number of steps. The motor's position can be controlled accurately without any feedback mechanism, as long as the motor is carefully sized to the application. Stepper motors are similar to switched reluctance motors.
- A Stepper Motor or a step motor is a brushless, synchronous motor which divides a full rotation into a number of steps. Unlike a brushless DC motor which rotates continuously when a fixed DC voltage is applied to it, a step motor rotates in discrete step angles. The Stepper Motors therefore are manufactured with steps per revolution of 12, 24, 72, 144, 180, and 200, resulting in stepping angles of 30, 15, 5, 2.5, 2, and 1.8 degrees per step. The stepper motor can be controlled with or without feedback.



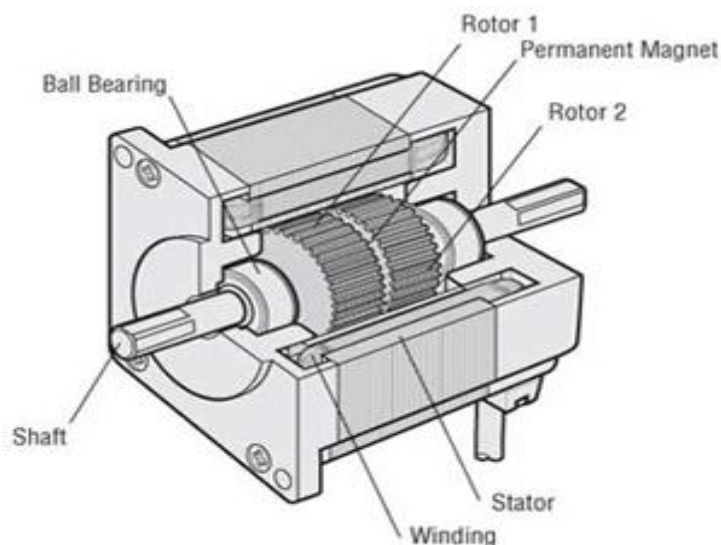
Types of Stepper Motor:

There are three main types of stepper motors, they are:

1. Permanent magnet stepper
2. Hybrid synchronous stepper
3. Variable reluctance stepper

Stepper motor construction:-

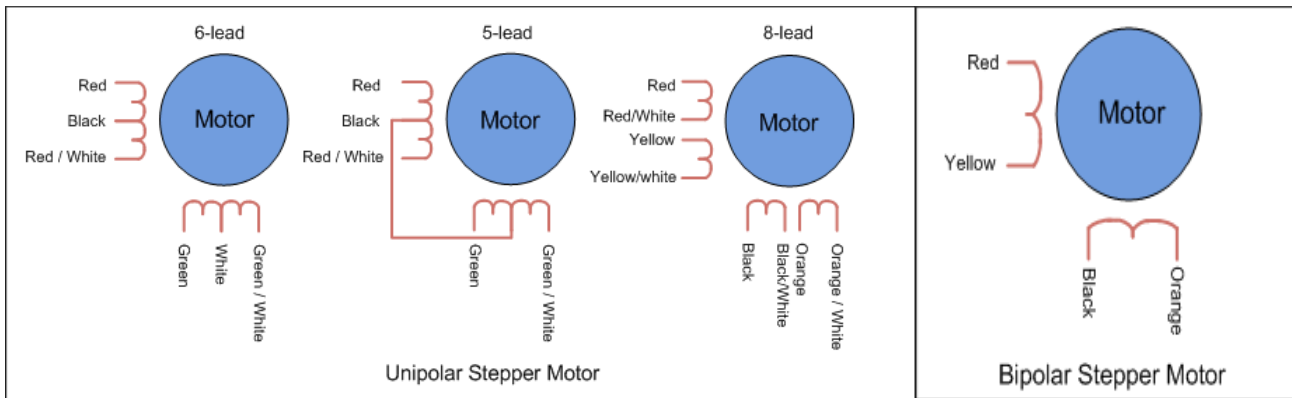
The figures below show two cross-sections of a 5-phase stepper motor. The stepper motor consists primarily of two parts: a stator and rotor. The rotor is made up of three components: rotor 1, rotor 2 and a permanent magnet. The rotor is magnetized in the axial direction so that, for example, if rotor 1 is polarized north, rotor 2 will be polarized south.



Motor Structural Diagram: Cross-Section Parallel to Shaft

Types of Wiring:-

The step motors are mostly two phase motors. These can be **unipolar or bipolar**. In unipolar step motor there are two winding per phase. The two winding to a pole may have one lead common i.e. centre tapped. The unipolar motor so, have five, six or eight leads. In the designs where the common of two poles are separate but centre tapped, motor have six leads. If the centre taps of the two poles are internally short, the motor has five leads.



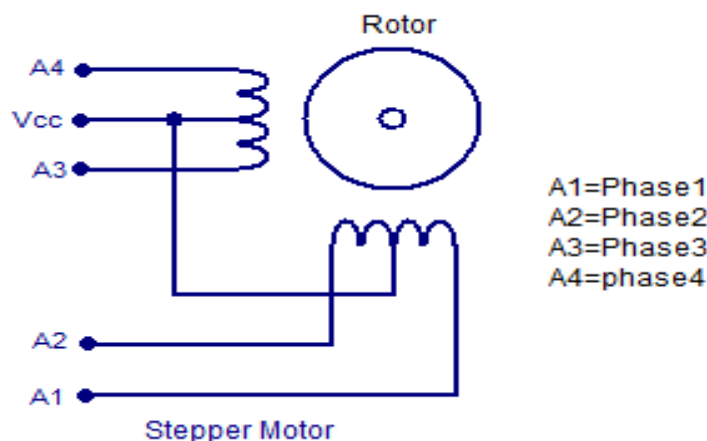
Stepping Modes:-

There are three stepping modes of a stepper motor. The stepping mode refers to the pattern of sequence in which stator coils are energized.

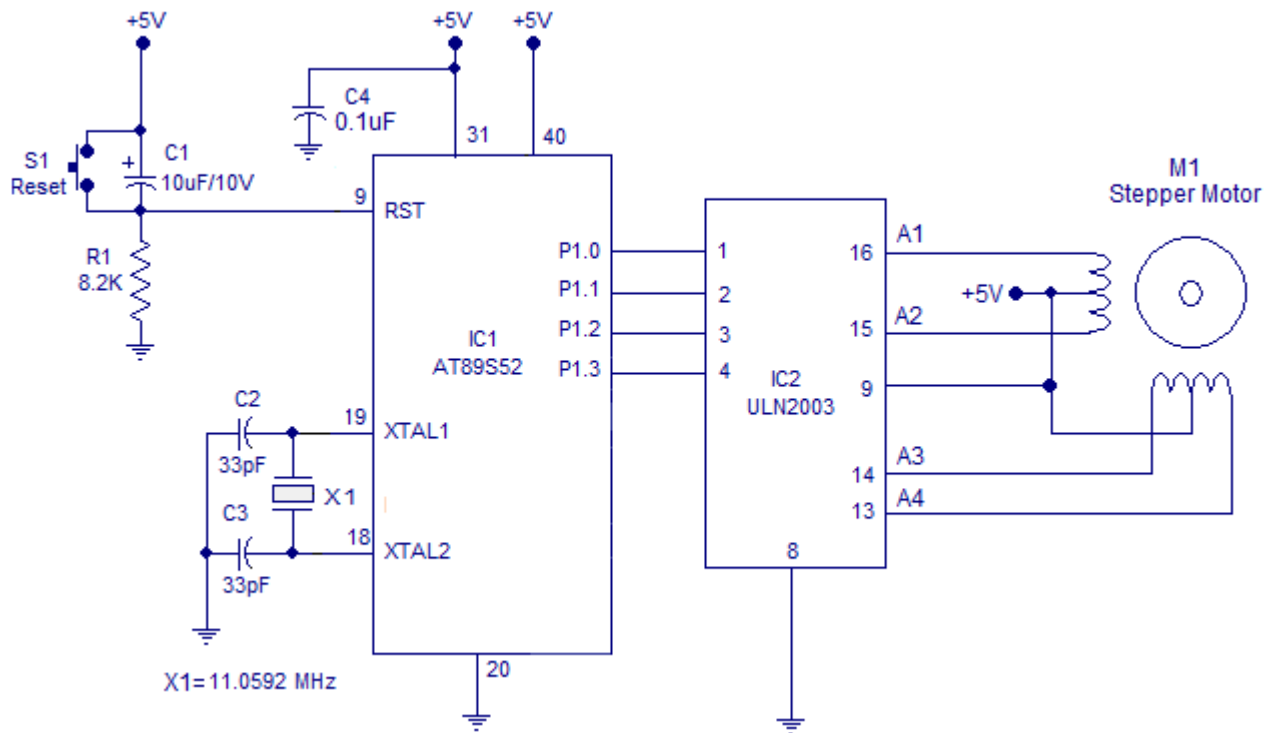
1. Wave drive (One phase ON at a time)
2. Full drive (Two phase ON at a time)
3. Half drive (One and two phase ON at a time)

Interfacing of bipolar stepper motor with microcontroller:-

A stepper motor usually have a number of field coils (phases) and a toothed rotor. The step size of the motor is determined by the number of phases and the number of teeth on the rotor. Step size is the angular displacement of the rotor in one step. If a stepper motor has 4 phases and 50 teeth, it takes $50 \times 4 = 200$ steps to make one complete rotation. So step angle will be $360/200 = 1.8^\circ$.



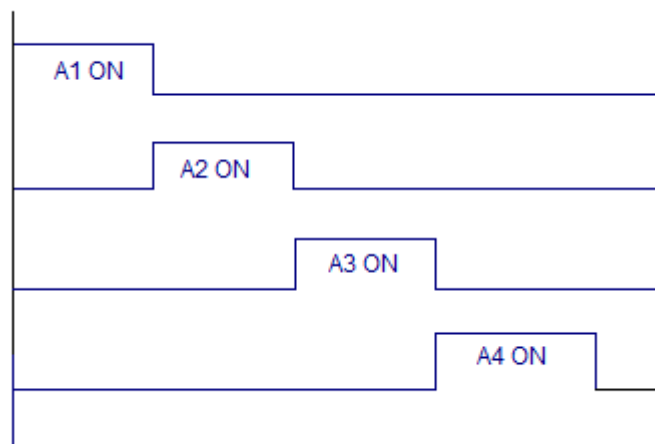
Circuit diagram:-



The circuit diagram for interfacing stepper motor to 8051 is shown above. P1.0, P1.1, P1.2 and P1.3 pins are used for controlling the phases A1, A2, A3 and A4 of the stepper motor respectively. ULN2003 is used for driving the individual phases of the stepper motor.

Test performance procedure:-

- The stepper motor is rotated by switching individual phases ON for a given time one by one.
- The sequence is given input as below.



- **4 stepwise drive sequence:-**

Step	A	B	C	D
0	1	0	0	0
1	0	1	0	0
2	0	0	1	0
3	0	0	0	1

Student Activity:-apply test performance on stepper motor available in laboratory, and a make drive sequence table for respective stepper motor.

Conclusion:-

Questions.

1. Write working principle of stepper motor?
2. What is the difference between stepper motor and DC motor?
3. State different types of stepper motors.
4. Write the various industrial applications of stepper motor
5. What is the difference between half drive and full drive?

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No: 7

Title: Identify /test various ICs (analog & digital) using IC tester.

Apparatus:

1. IC tester trainer
2. ICs

Theory:

What is IC tester?

IC testers or integrated circuit tester are used to test or check the condition of IC before it is used in any circuit. It functionally tests variety of ICs and displays PASS or FAIL accordingly. Reasons to test after the IC has been placed on the board:

- To verify the proper chip orientation
- To verify its correct device
- To verify basic operations of the board
- To program and verify In-System-Programmable (ISP) device contents.

FEATURES

- An IC tester is normally compact, rugged and easy to use.
- It is a portable device.
- It can automatically test variety of digital ICs of 6, 8, 10, 14, 16, 18, 20, 24, 28, and 40 pins.
- Requires no add-on or plug-in hardware for testing, all the required hardware is in-built.
- Facility to test ICs now and again until it is stopped
- Self testing facility through 'PIN TEST FACILITY' of the keyboard.
- Facility to identify the IC number using 'AUTO FIND' of selective IC only.
- Audio buzzer for bringing the user's attention.

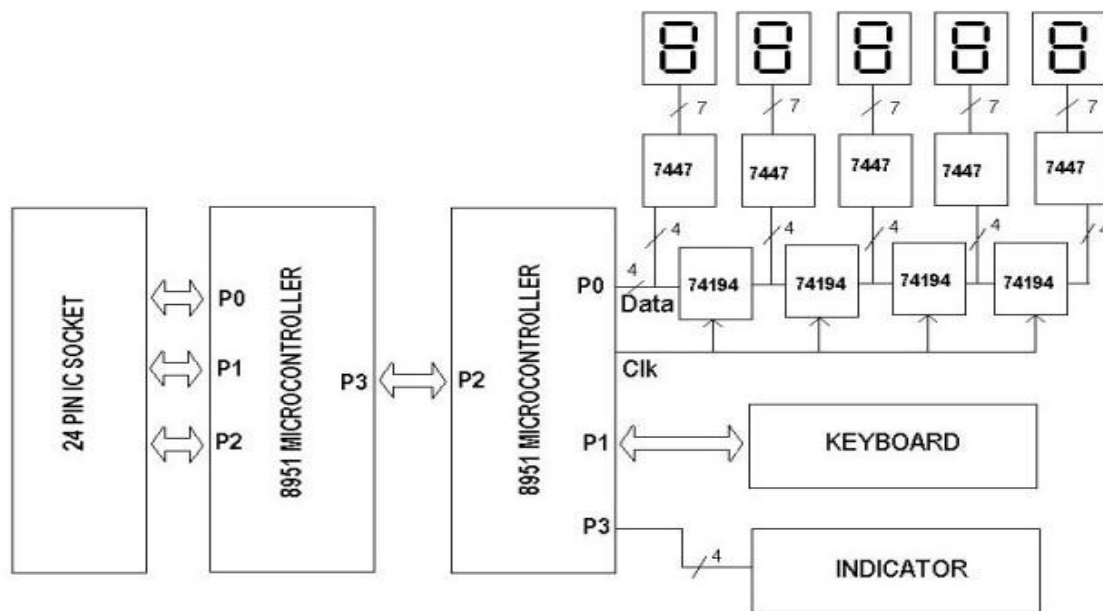


- To test a particular digital IC, one needs to insert the IC into the IC socket and enter the IC number using the keyboard and then press the “ENTER” key. The IC number gets displayed in the 7-segment display unit.

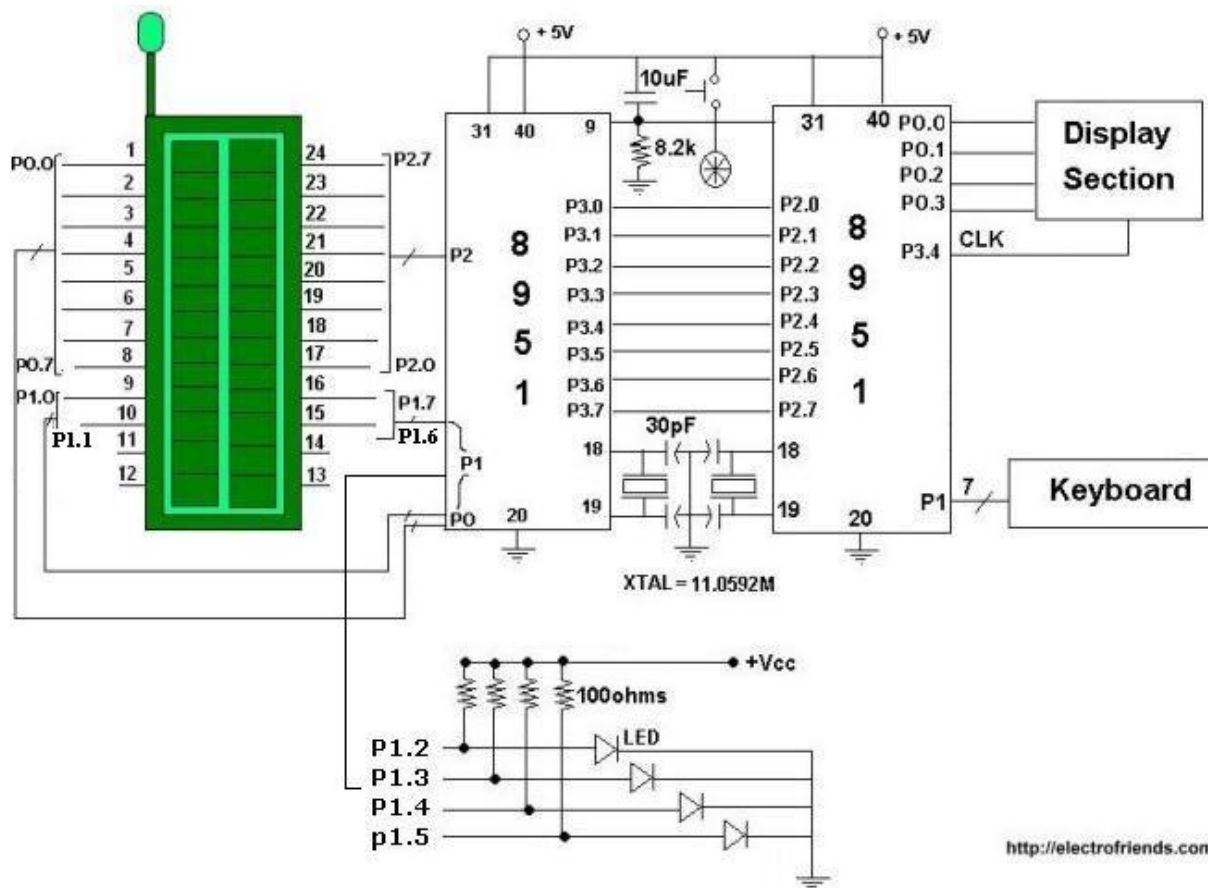
Block diagram of IC tester:-

The block diagram of the programmable digital IC tester is as shown in below. It consists of two 8951 microcontroller ICs, a 24-pin IC socket, a keyboard unit, a display unit and indicators

The programmable digital IC tester consists of 2 8951 microcontroller. One is called master and the other slave. The master controls the slave and the working of the display and keyboard units. The slave IC is used for testing the IC inserted into the IC socket. Out of the four ports available in the 8951, three ports – port 0, port 1(Not all pins), port 2 are connected to the 24 pins of the IC socket. Port 3 is used for parallel communication between the slave and the master.



Block Diagram of Programmable Digital IC Tester



The keyboard and display units are interfaced with the master IC. Four indicators are also connected to the master IC. When we feed the number of the IC being tested, the number gets stored in the memory of the master IC and also gets displayed in the in the 7-segment display. The display unit is connected to the lower pins of port 0 of the master IC. The keyboard is connected to port 1 and the four indicators are connected to the port 1 of Slave IC

KEYS AND FUNCTIONS

The IC tester has a 16 keys keyboard, each key with a specific function. The keys can be broadly classified into two categories: DATA INPUT KEYS and COMMAND INPUT KEYS.

- **DATA INPUT KEYS:** These keys are used to enter the IC number. Keys with markings 0, 1, 2,3, 4, 5, 6, 7, 8 and 9 come in this category. They are sometimes called numeric keys
- **COMMAND INPUT KEYS:** ALGO, ENTER, AUTO FIND, PIN TEST, LOOP TEST and CLEAR keys are the six command input keys which are used to give command to the device.

Serial no.	Key Description	Key Function
1.	0 to 9	To enter numeric portion of IC number
2.	CLEAR	Clear the complete display
3.	ENTER	To start the testing of IC which is entered in display
4.	ALGO	The key shows the entire range of the devices whose algorithm is same to the device which is entered
5.	AUTO FIND	It locates the digital IC number upto 20 pins..
6.	PIN TEST	Used to test the pins from 1 to 39 of ZIF socket.
7.	LOOP TEST	This key is used to test a device for continuously

IC testing procedure:-

1. First the IC need to be inserted in the ZIF socket orienting IC top (dot or the notch) with the ZIF top taking precautions. Then lock the IC using the lever in the ZIF socket. The system will start testing only if the IIC is inserted properly.

2. Enter the IC number using data input keys as discussed above and press <ENTER> key. As soon as the <ENTER> key is pressed the system checks for a valid IC number available in its test library. For a valid IC number it displays:

For GOOD IC:

P	A	S	S		
---	---	---	---	--	--

For BAD IC:

F	A	I	L		
---	---	---	---	--	--

3. if the given IC number is not available in the test library then an Error message is displayed,

Observation table:-

- Test the different ICs available in laboratory according given stepwise procedure. and complete the following observation table.

Sr.No	IC number and make	Remark GOOD/BAD
1		
2		
3		
4		
5		

Conclusion:-

Questions.

1. Define integrated circuit.
2. What is IC tester? State its features.
3. What is the difference between analog and digital IC tester?
4. Write the features of IC tester available in laboratory.
5. List out different IC tester according to its features.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No: 8

Title:-Troubleshoot the data projector

Apparatus:

1. Data projector.
2. Connecting cables.
3. Personal computer.

Theory:

Definition of:- data projector:-

A device that projects computer output onto a white or silver fabric screen that is wall, ceiling or tripod mounted. It is widely used in classrooms and auditoriums for instruction and slide presentations.

A digital projector is an electronic device that is capable of connecting to a computer or other device and projecting the video output onto a screen or wall. Digital projectors can be either fixed onto the ceiling, placed on a stand or can even be portable. Digital projectors are used in situations such as office training or presentation sessions, classroom teaching and home cinemas.

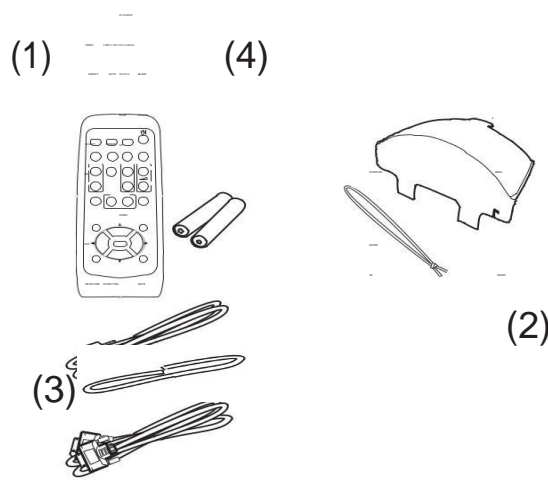
Uses:-

The most ubiquitous use of a data projector is for presentations in business meetings or classrooms. Presentation software allows a user to create slide shows of photos, type written information and display graphs. Teachers in high school and college make extensive use of data projectors to give notes or lectures, as do businesspeople making presentations to co-workers or clients.

Checking the contents of package:-

Your projector should come with the items shown below. Check that all the items are included. Require of your dealer immediately if any items are missing.

- (1) Remote control with two AA batteries
- (2) Power cord
- (3) Computer cable
- (4) Lens cover and Strap
- (5) User's manuals (Book x1, CD x1)
- (6) Security label

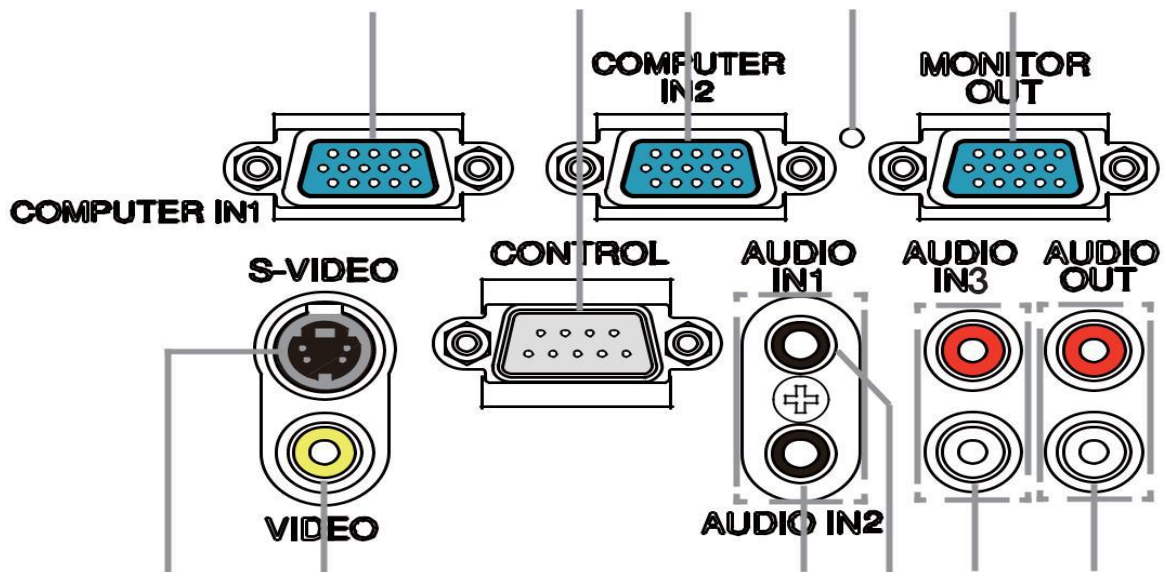


Control panel

- (1) **STANDBY/ON** button
- (2) **INPUT** button
- (3) **MENU** button
It consists of four cursor buttons
- (4) **POWER** indicator
- (5) **TEMP** indicator
- (6) **LAMP** indicator





Rear panel

- | | |
|-----------------------|-----------------------------|
| (1) AUDIO IN1 port | (8) VIDEO port |
| (2) AUDIO IN2 port | (9) S-VIDEO port |
| (3) COMPUTER IN1 port | (10) AUDIO IN3 (R, L) ports |
| (4) COMPUTER IN2 port | (11) AUDIO OUT (R, L) ports |
| (5) MONITOR OUT port | |
| (6) Shutdown switch | |
| (7) CONTROL port | |



Related messages:-

When some message appears, check and cope with it according to the following table. Although these messages will be automatically disappeared around several minutes, it will be reappeared every time the power is turned on.

Message	Description
	<p>There is no input signal.</p> <p>Please confirm the signal input connection, and the status of the signal source.</p>
	<p>The horizontal or vertical frequency of the input signal is not within the specified range.</p> <p>Please confirm the specs for your projector or the signal source specs.</p>
	<p>An improper signal is input.</p> <p>Please confirm the specs for your projector or the signal source specs.</p>
	<p>The interior temperature is too high, or has increased or decreased in a short term.</p> <p>Please turn the power off, and allow the projector to cool down at least 20 minutes. After having confirmed the following items, please turn the power on again.</p> <ul style="list-style-type: none"> • Is there blockage of the air passage aperture?

Phenomena that may be easy to be mistaken for machine defects.

Phenomenon	Cases not involving a machine defect
Pictures appear dark.	<p>The brightness and/or contrast are adjusted to an Extremely low level.</p> <p>Adjust the BRIGHTNESS and/or the CONTRAST settings to a higher level using the menu function.</p>
	<p>The ECO MODE function is working.</p> <p>Select the NORMAL for the ECO MODE item in the SETUP menu.</p>
	<p>The lamp is approaching the end of its product lifetime.</p> <p>Replace the lamp.</p>
Pictures appear blurry.	<p>Either the focus and/or horizontal phase settings are not properly adjusted.</p> <p>Adjust the focus using the focus ring, and/or the H PHASE using the menu function.</p>
	<p>The lens is dirty or misty.</p> <p>Clean the lens referring to the section “Caring for the lens”.</p>
When the ASPECT is set to NATIVE,	<p>Vertical resolution of the input signal is equal to or more than the vertical resolution of display area that is Determined by 1.5 x D-ZOOM adjustment value.</p>

Maintenance of Electronics Equipment & EDA Tools Practices (22036)

<p>PICTURE POSITION does not work even if the vertical size of the displayed image does not fit visually on the effective display area.</p>	<p>Change input signal resolution or/and D-ZOOM adjustment value so that vertical resolution of the input signal is less than 1.5 x D-ZOOM adjustment value (34).</p>
<p>RS-232C does not work.</p>	<p>The SAVING function is working. Select NORMAL for STANDBY MODE item in the SETUP menu.</p>

Complete Specifications table of data projector in laboratory:-

Item	Specification
Product name	
Liquid Crystal Panel	
Lens	
Lamp	
Speaker	
Power supply	
Power consumption	
Temperature range	

Size	
Weight (mass)	
Ports	<p>Computer input port</p> <p>Computer output port</p> <p>Video input port</p> <p>Audio input/output port</p>
Optional parts	<p>Lamp:</p> <p>Filter set:</p> <p>Mounting accessory:</p> <p>Laser remote control:</p> <p>Cable cover:</p>

Conclusion:-

Questions.

1. Define Data projector
2. What are the different applications of data projector?
3. What are the common ports available with data projector?
4. What are different types of cables required for interfacing the data projector?
5. List out the various features of data projector.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No: 9

Title:-Troubleshoot the circuit breaker (MCB and ELCB).

Apparatus:

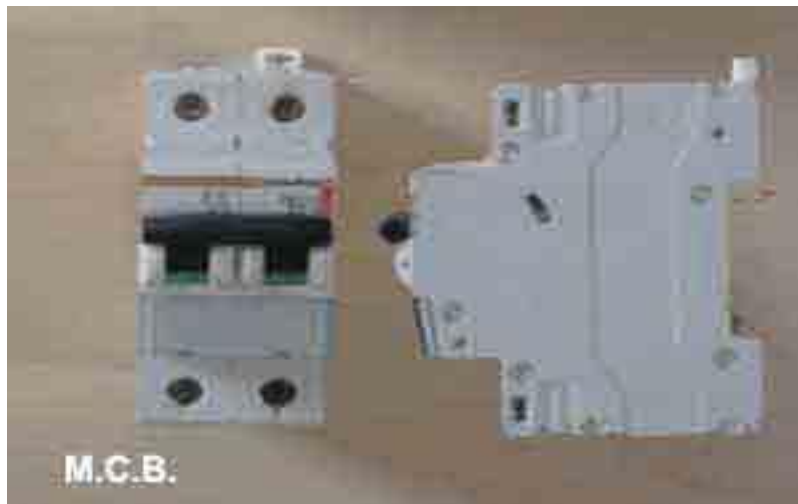
1. MCB
2. ELCB
3. Multimeter
4. Connecting wires.

Theory:

Miniature Circuit Breaker (MCB):-

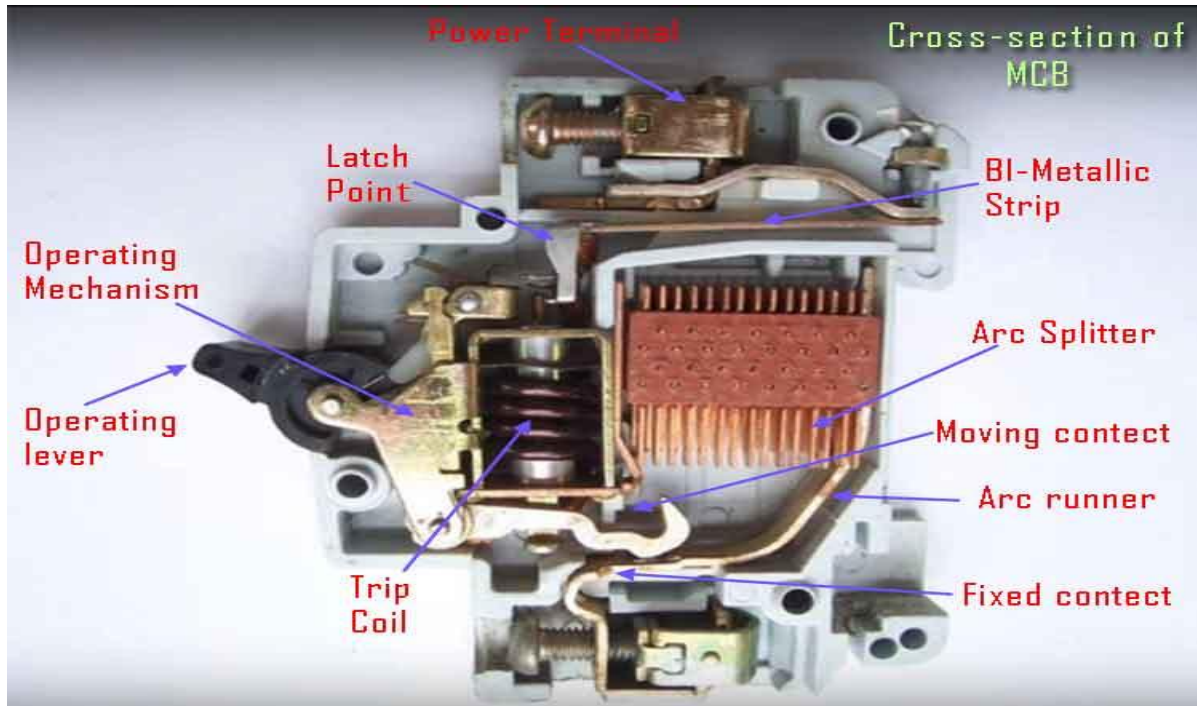
What is MCB?

It automatically switches off the electrical circuit during abnormal condition of the network means in over load condition as well as faulty condition. The fuse does not sense but miniature circuit breaker does it in more reliable way. MCB is much more sensitive to over current than fuse.



- Another advantage is, as the switch operating knob comes at its off position during tripping, the faulty zone of the electrical circuit can easily be identified. But in case of fuse, fuse wire should be checked by opening fuse grip or cutout from fuse base, for confirming the blow of fuse wire.
- Quick restoration of supply can not be possible in case of fuse as because fuses have to be rewirable or replaced for restoring the supply. But in the case of MCB, quick restoration is possible by just switching on operation.

Miniature Circuit Breaker (MCB) Construction:-



The trip unit is the main part, responsible for proper working of miniature circuit breaker. Two main types of trip mechanism are provided in MCB. A bimetal provides protection against over load current and an electromagnet provides protection against short-circuit current.

- If circuit is overloaded for long time, the bi - metallic strip becomes over heated and deformed. This deformation of bi metallic strip causes, displacement of latch point. The moving contact of the MCB is so arranged by means of spring pressure, with this latch point, that a little displacement of latch causes, release of spring and makes the moving contact to move for opening the MCB.
- During short circuit fault the mmf of that coil causes its plunger to hit the same latch point and make the latch to be displaced. Hence the MCB will open in same manner.

Earth leakage circuit breaker (ELCB):-

What is ELCB?:- An Earth-leakage circuit breaker (ELCB) is a safety device used in electrical installations with high Earth impedance to prevent shock. It detects small stray voltages on the metal enclosures of electrical equipment, and interrupts the circuit if a dangerous voltage is detected. Once

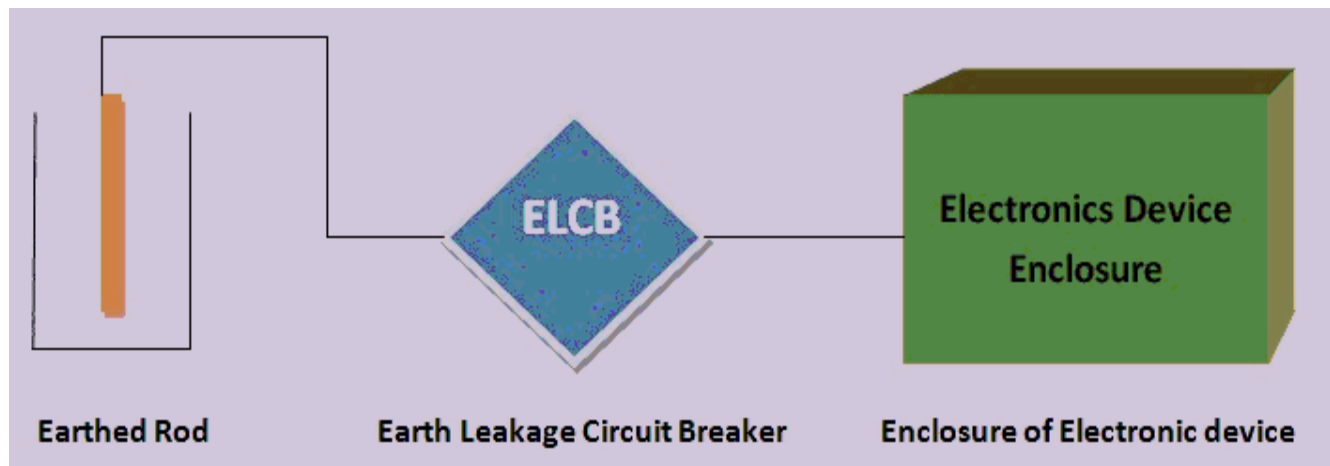
widely used, more recent installations instead use residual current circuit breakers which instead detect leakage current directly.



An ELCB is a specific type of latching relay that has a structure's incoming mains power associated through its switching contacts so that the circuit breaker detaches the power in an unsafe condition. The ELCB notices fault currents of human or animal to the earth wire in the connection it guards.

How to Connect Earth Leakage Circuit Breaker:-

The earth circuit is adapted when an ELCB is used; the connection to the earth rod is accepted through the earth leakage circuit breaker by linking to its two earth terminals. One goes to the fitting earth circuit protective conductor (CPC), and the other to the earth rod or another kind of earth connection. Thus the earth circuit permits through the ELCB's sense coil.

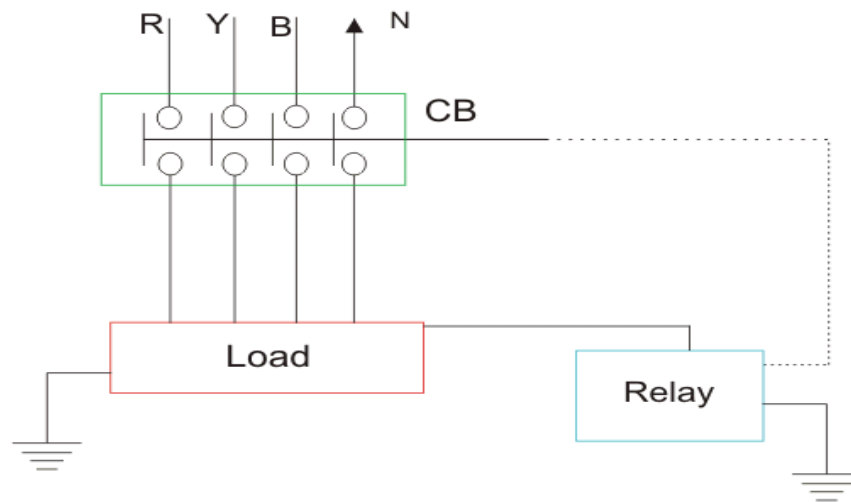


There are two types of Earth Leakage Circuit Breaker (ELCB)

1. Voltage Operated ELCB
2. Current Operated ELCB

Working Voltage Earth Leakage Circuit Breaker:-

The working principle of voltage ELCB is quite simple. One terminal of the relay coil is connected to the metal body of the equipment to be protected against earth leakage and other terminal is connected to the earth directly.



If any insulation failure occurs or live phase wire touches the metal body, of the equipment, there must be a voltage difference appears across the terminal of the coil connected to the equipment body and earth. This voltage difference produces a current to flow the relay coil. If the voltage difference crosses, a predetermined limit, the current through the relay becomes sufficient to actuate the relay for tripping the associated circuit breaker to disconnect the power supply to the equipment.

Stepwise procedure:-

- Observe your lab installation.
- Observe the incoming main supply panel of your college.
- Observe distribution system, and their location.
- Identify the make and rating of the MCB and ELCB used in lab.

- Make a short circuit in 5A plug socket.
- Observe which MCB is tripped.

Conclusion:-

Questions.

1. Compare Fuse and MCB.
2. What is meant by ELCB? State its different types.
3. State which circuit breaker is used to prevent against electrical shocks.
4. Write the specifications of MCB which is used for residential and commercial purpose.
5. State the different parts in MCB.
6. Write advantages of MCB and ELCB.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no. 10

Title:- Install DTH receiver(Indoor and outdoor unit).

Apparatus:-

4. Dish antenna
5. Universal LNBF
6. Low Loss RF cable (RG-6)
7. Satellite Receiver with Remote controller(SATTOP Box)
8. Audio Video Cable.

Theory:

What is DTH ?

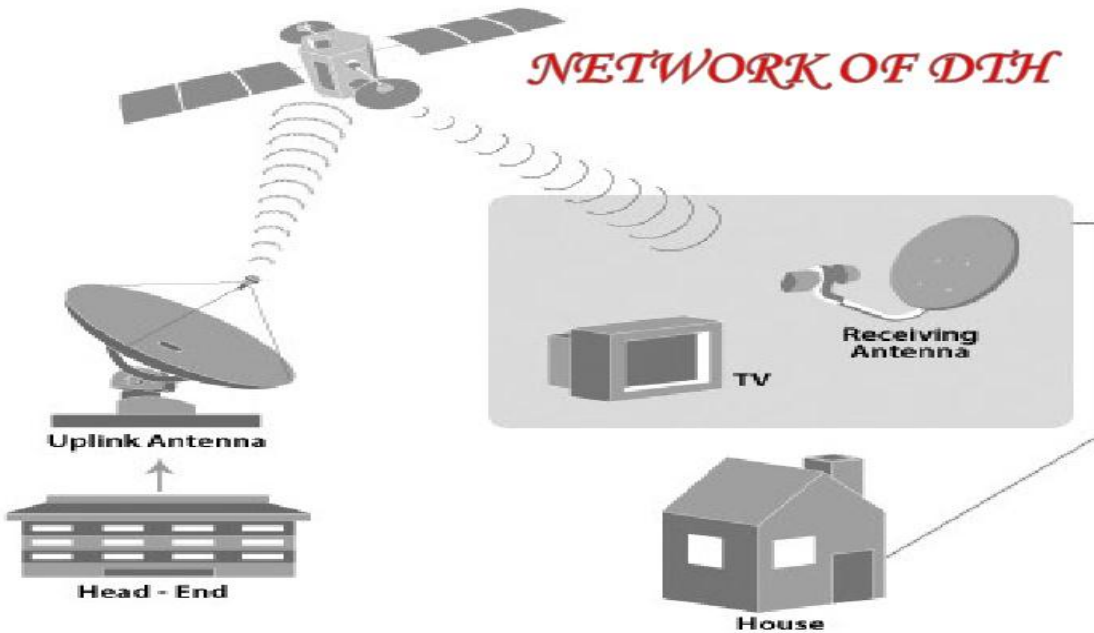
Direct to home technology refers to the satellite television broadcasting process which is actually intended for home reception. This technology is originally referred to as direct broadcast satellite (DBS) technology. The technology was developed for competing with the local cable TV distribution services by providing higher quality satellite signals with more number of channels.

In short, DTH refers to the reception of satellite signals on a TV with a personal dish in an individual home. The satellites that are used for this purpose is geostationary satellites. The satellites compress the signals digitally, encrypt them and then are beamed from high powered geostationary satellites. They are received by dishes that are given to the DTH consumers by DTH providers.

DTH Architecture:-

For a DTH network to be transmitted and received, the following components are needed.

- Broadcasting Centre
- Satellites
- Encoders
- Multiplexers
- Modulators
- DTH receivers



There are five major components involved in a direct to home (DTH) satellite system: the programming source, the broadcast center, the satellite, the satellite dish and the receiver.

- Programming sources are simply the channels that provide programming for broadcast. The provider doesn't create original programming itself; it pays other companies (HBO, for example, or ESPN) for the right to broadcast their content via satellite. In this way, the provider is kind of like a broker between you and the actual programming sources. (Cable TV companies work on the same principle.)
- The broadcast center is the central hub of the system. At the broadcast center, the TV provider receives signals from various programming sources and beams a broadcast signal to satellites in geosynchronous orbit.
- The satellites receive the signals from the broadcast station and rebroadcast them to Earth.
- The viewer's dish picks up the signal from the satellite (or multiple satellites in the same part of the sky) and passes it on to the receiver in the viewer's house.
- The receiver processes the signal and passes it on to a standard TV.

Universal low noise block down converter (LNBF):-



A low-noise block down converter (LNB) is the receiving device mounted on satellite dishes used for satellite TV reception, which collects the radio waves from the dish and converts them to a signal which is sent through a cable to the receiver inside the building. Also called a low-noise block, low-noise converter (LNC), or even low-noise down converter (LND), the device is sometimes inaccurately called a low-noise amplifier (LNA).

SET TOP BOX :-



Set top box is an intermediate device which provides an intermediate platform between user and internet and it provides the environment to the system to decode the digital television signal. This set top box is act like a receiver, and is necessary for the analog systems who want to receive the digital channels. STB's are program based devices they are controlled by micro controllers. These boxes are used to control the television channels. Set-top boxes are used to control the conversion of the media signal transmitted from a content provider into the images and sounds that are provided by a corresponding media display device.

INSTALLATION PROCEDURE FOR DTH:-

1.0 UNPACKING PROCEDURE:

- 1.1 Unpack Antenna from Antenna Box.
- 1.2 Unpack All accessories and Receiver from accessories Box.

2.0 SITE SELECTION:

- 2.1 Preferably install the DTH antenna system through qualified and trained person.
- 2.2 Locate the Place for the antenna installation.
- 2.3 There should not be any obstructions like trees, buildings, or any other objects in the South East direction or towards satellite direction. This is the direction where satellite is available. There should not be any high power lines, terrestrial link lines or any kind of RF interference like RFI & EMI radiations near the site where the antenna is to be installed.
- 2.4 The antenna mount is compatible for Wall and Ground Mount.

3.0 ASSEMBLY PROCEDURE:

3.1 Assemble the wall mount/ground mount stand as per the drawing, Mark the holes on wall/terrace roof, use proper electrical drill machine and drill bit, Drill should be 8 mm thick and drill hole up to 3 inch depth deep in the wall for all the holes, Insert wooden grip plug up to 3 inch depth deep in the hole properly, mark center point on all inserted wooden grips. screw all the sheet metal screws and washer(Item No: 13 / 11) up to maximum depth using the proper screw driver.

3.2 Tight all the Nuts, Bolts and screws (Item No:2 / 12 / 13), Make sure that it should not be lose at all. completing this, check for the wall mount stand grip/strength It should be strong enough to take the antenna load, Check the Rigidity of the antenna by shaking the Antenna mount.

3.3 Assemble Az-El mount as per drawing ,Make sure the degree marking must be as per the drawing ,this is most important for correct elevation alignment , first fit LNB arm properly with the big clamp than remove small screw/Nut (4-mm / item no 15/16) from the big clamp, Assemble small clamp with U-bolts, Nuts and washer , insert the small clamp in to the big clamp than fit small screws and nut as per the drawing in the center of the clamp, insert 5/16 “ bolt/Nut/washer(Item no:6/7/8) as per the drawing, keep all nuts and bolts loose up to the final assembly.3.4 Fit Az-El Mount with antenna as marked in the drawing (Keep Doordarshan Logo -upper side) tight all Nuts, Bolts and Washer of (item no:01/02/11)

3.5 Now fit properly LNB holder (Plastic clamp) as per the drawing also fit LNBF on the LNB holder, keep the output connector direction towards the ground side,

3.6 Mount the entire antenna assembly on the wall mounted stand ,keep Nuts and Bolts of Az-El mount partly loose up to the antenna alignment

3.7 Now interconnect all cables like LNB to Receiver and Receiver to TV set as per the drawing.

Conclusion:-

Questions.

1. What is DTH?
2. State different components of DTH architecture.
3. What is function LNB in DTH?
4. Compare cable television and DTH TV.
5. What is function of setup box?
6. write advantages of DTH over cable television.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment no. 11

Title:- Troubleshoot the Regulated power supply circuit of the given equipment.

Apparatus:

1. DC Regulated power supply.
2. CRO
3. Digital multimeter.
4. Connecting probes and wires.

Theory:

Regulated Power Supply:-

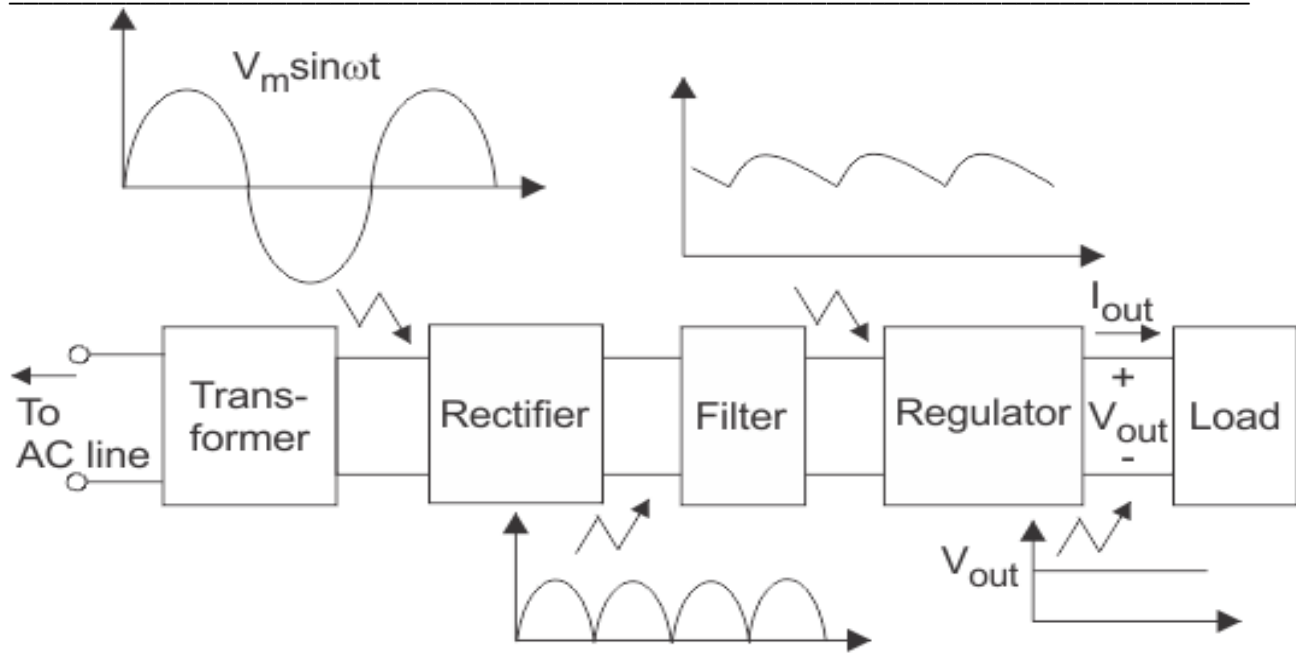
Today almost every electronic device needs a DC supply for its smooth operation and they need to be operated within certain power supply limits. This required DC voltage or DC supply is derived from single phase ac mains.

A regulated power supply can convert unregulated an AC (alternating current or voltage) to a constant DC (direct current or voltage). A regulated power supply is used to ensure that the output remains constant even if the input changes. A regulated DC power supply is also called as a linear power supply, it is an embedded circuit and consists of various blocks.

The regulated power supply will accept an AC input and give a constant DC output. Figure below shows the block diagram of a typical regulated DC power supply.

The basic building blocks of a regulated DC power supply are as follows:

1. A step down transformer
2. A rectifier
3. A DC filter
4. A regulator



Components of typical linear power supply

Operation of Regulated Power Supply:-

Step Down Transformer:-

A step down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit.

Rectification:-

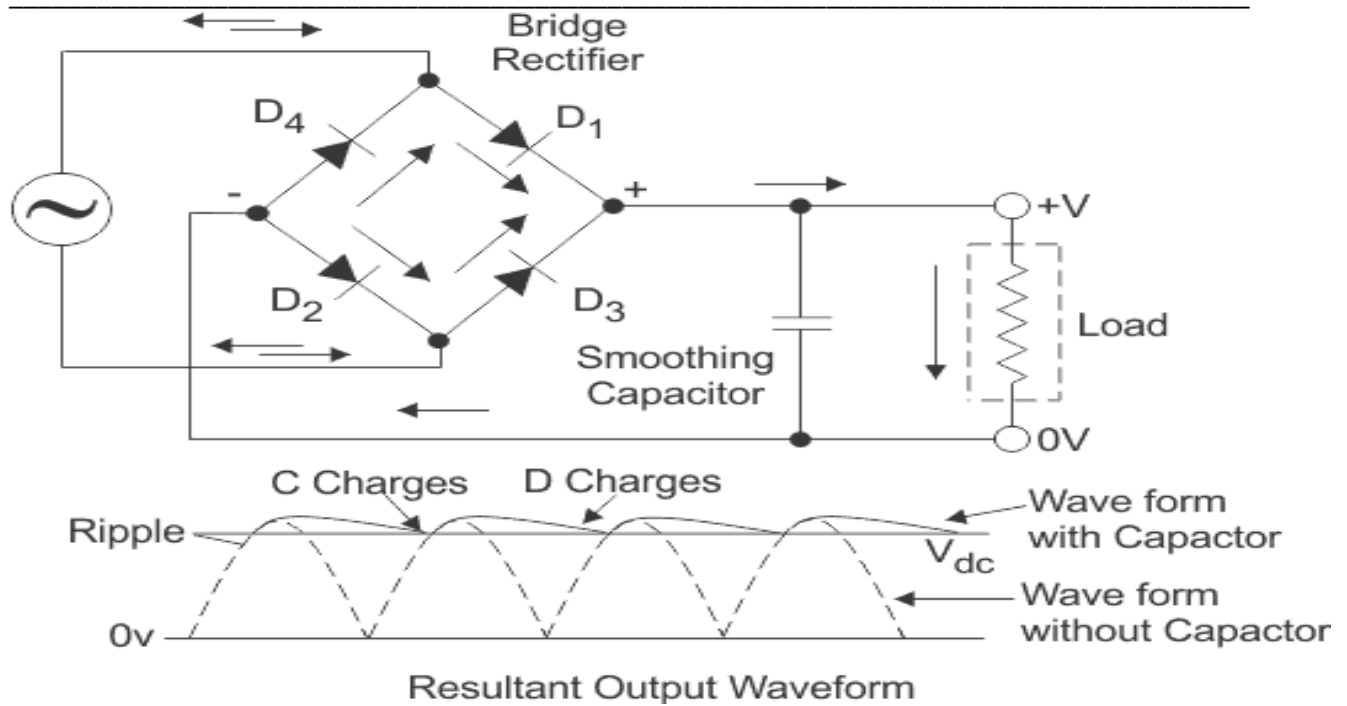
Rectifier is an electronic circuit consisting of diodes which carries out the rectification process. Rectification is the process of converting an alternating voltage or current into corresponding direct (DC) quantity. The input to a rectifier is ac whereas its output is unidirectional pulsating DC.

DC Filtration:-

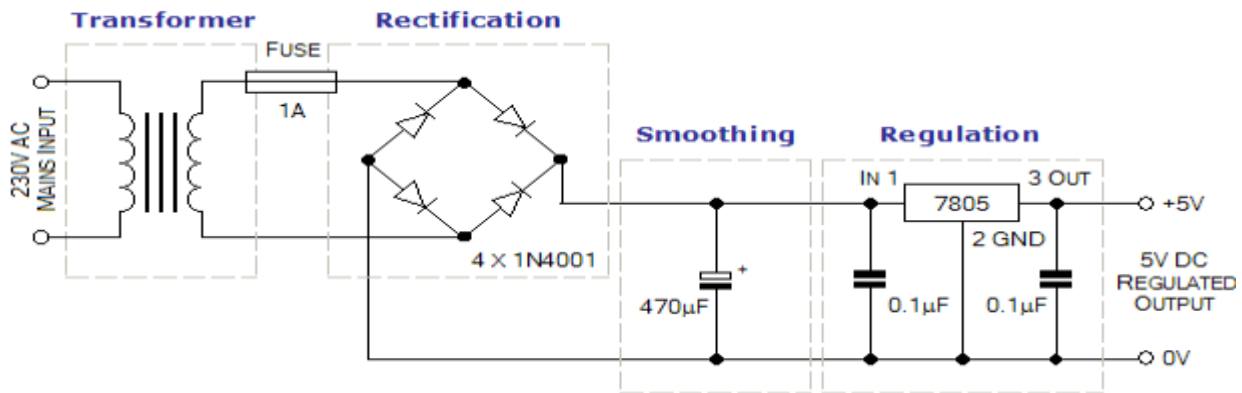
The rectified voltage from the rectifier is a pulsating DC voltage having very high ripple content. But this is not we want, we want a pure ripple free DC waveform. Hence a filter is used. Different types of filters are used such as capacitor filter, LC filter, Choke input filter, π type filter.

Regulation:-

This is the last block in a regulated DC power supply. The output voltage or current will change or fluctuate when there is change in the input from ac mains or due to change in load current at the output of the regulated power supply or due to other factors like temperature changes



Sample circuit diagram:-



Actual Circuit used in equipment:-

Stepwise Procedure:-

1. Do the physical observations of different section of given power supply.
2. Draw the circuit diagram of the given power supply and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage sketch waveforms at all the check points in the table.
5. Compare the voltage value at given point with expected value, and then identify the fault in given supply.

Observation table:-

Sr.No.	Test Points	Standard Value	Measured Value	Observed Waveforms
1	Primary of Transformer			
2	Secondary of Transformer			
3	Output of Rectifier			
4	Output of Filter			
5	Output of Regulator			

Conclusion:-

Questions:-

1. Define Regulated power supply.
2. What are basic blocks in Regulated power supply?
3. Write function of rectifier and filter in Regulated power supply.
4. List different types of filters.
5. What is regulator? List the different regulator ICs.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 12

Aim : Troubleshoot the given mixer/grinder with fractional horse power.

Apparatus:-

1. Mixer/grinder with FHP.
2. Connecting wires.
3. Multimeter.

Theory:

What is Mixer/Grinder:-

A mixer grinder is a very useful domestic appliance of the kitchen and is used to grind fruits, nuts, vegetables etc and to prepare delicious drinks like milk shakes. Dry grinding of spices, cereals, pulses, seeds, dry fruits etc and wet grinding of garlic, ginger, onion, vegetables etc are also done in mixer grinders. There are mixture grinders for mincing meat. Hotels and restaurants use high capacity mixer grinders. Different types of mixer grinders are also known as Food processor, juicer and grinder, food grinder, mixi, liquidizer etc.

The main parts of a basic mixer grinder are—

1. Electric motor
2. Speed control switch
3. Overload protection and reset switch
4. Coupling
5. Jars and blades
6. Body
7. Accessories

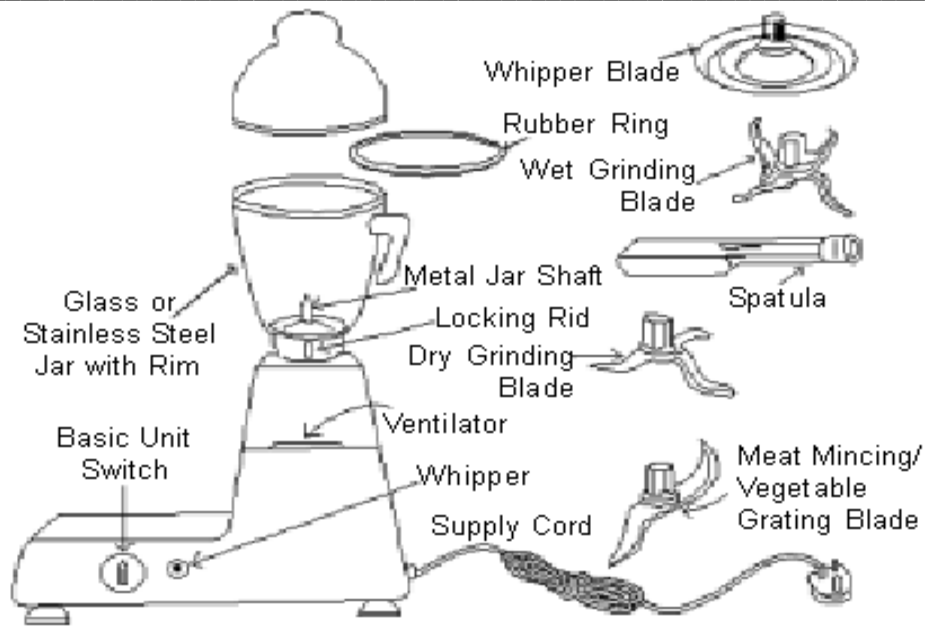
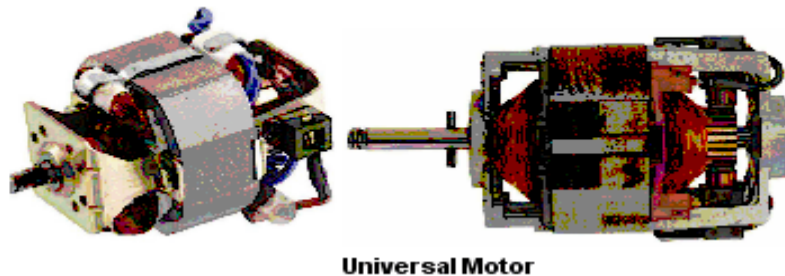


Fig. 4.9 Parts of Mixer Grinder

- Numerous models of different capacities from various manufacturers are available. Now-a-days efficient models with attractive getup and added features are available and they make less noise and vibration compared to older models. Domestic mixer grinders work on 220 volt AC and commonly have power rating between 500 watt to 1.5 kW. Typical values are 500 watt, 750 watt, 1.1 kW etc. Maximum speed of 18000 to 20000 RPM is common.
- The motor used in mixer grinder is generally a universal motor. The motor has stator and rotor. The stator is made of laminated steel. There are poles on the stator. Usually two poles are there. Field coils are wound on each pole. The rotor, also called armature is also made of laminated steel, has slots and is tightly fitted with the shaft. Rotor windings are placed on rotor slots.



Universal Motor

- Ends of rotor windings are permanently connected to commutator segments. Commutator segments are around the shaft on one side. There are two brushes that make contact with two commutator segments at a particular instant. As shaft rotates, the commutator segments that come in contact with the brushes also change. Field windings in the stator and rotor windings are connected in series through the rotor commutator. Universal motor can run on both AC and DC. They have high starting torque and speed.
- The motor is fitted to the base unit with its shaft in vertical position. A top bowl contains the couplings that are tightly fitted on the top of the shaft where jars with blades are placed. The base of top bowl is sealed by rubber gaskets and is made leak proof. Couplings are made of high quality food grade plastic or polycarbonate materials.

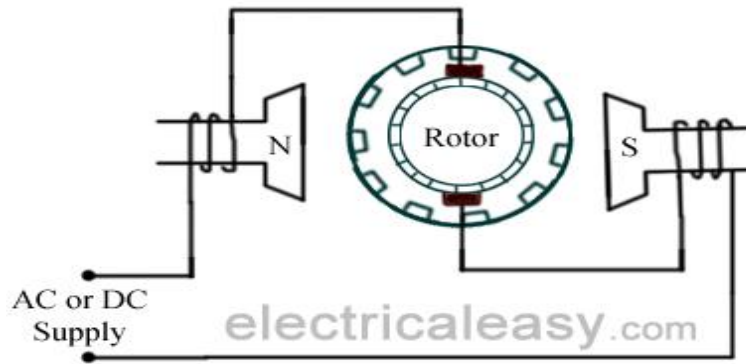
Construction of Universal motor:-



- Construction of a universal motor is very similar to the construction of a DC machine. It consists of a stator on which field poles are mounted. Field coils are wound on the field poles. However, the whole magnetic path (stator field circuit and also armature) is laminated. Lamination is necessary to minimize the eddy currents which induce while operating on AC.

Working of universal motor:-

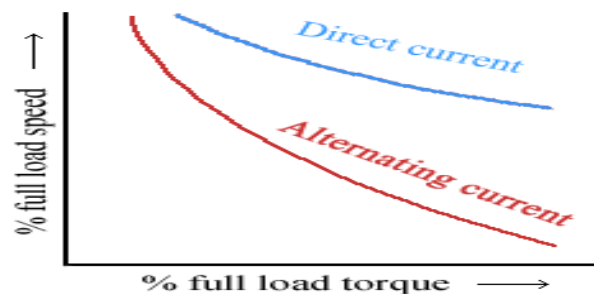
- A universal motor works on either DC or single phase AC supply. When the universal motor is fed with a DC supply, it works as a DC series motor



- The same current also flows from the armature conductors. When a current carrying conductor is placed in an electromagnetic field, it experiences a mechanical force. Due to this mechanical force, or torque, the rotor starts to rotate. The direction of this force is given by Fleming's left hand rule.

Speed/load characteristics:-

- Speed/load characteristics of a universal motor is similar to that of DC series motor. The speed of a universal motor is low at full load and very high at no load. Usually, gears trains are used to get the required speed on required load. The speed/load characteristics are (for both AC as well as DC supply) are shown in the figure.



Specifications of motor in laboratory:

Model	
Voltage	
Frequency	
Power	
Winding	
Stator	

Stepwise Procedure:-

1. Do the physical observations of different section of given mixer/grinder.
2. Draw the circuit diagram of the given mixer/grinder and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage at all the check points.
5. Compare the voltage value at given point with expected value, and then identify the fault in given mixer/grinder.

Observation Table:-

Sr.No.	Check point	Measured value	Excepted value

Mention the different faults in troubleshooting of given mixer/grinder:-

- 1.
- 2.
- 3.

Conclusion:-

Questions:-

1. What are applications of mixer/grinder?
2. State working principle of universal motor.
3. Draw the Schematic for different types of universal motor.
4. State the difference between universal motor and DC motor.
5. What is function of stator in universal motor?

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 13

Aim: Assemble the various parts of the computer system and install operating system, application software & antivirus on a computer.

Apparatus:-

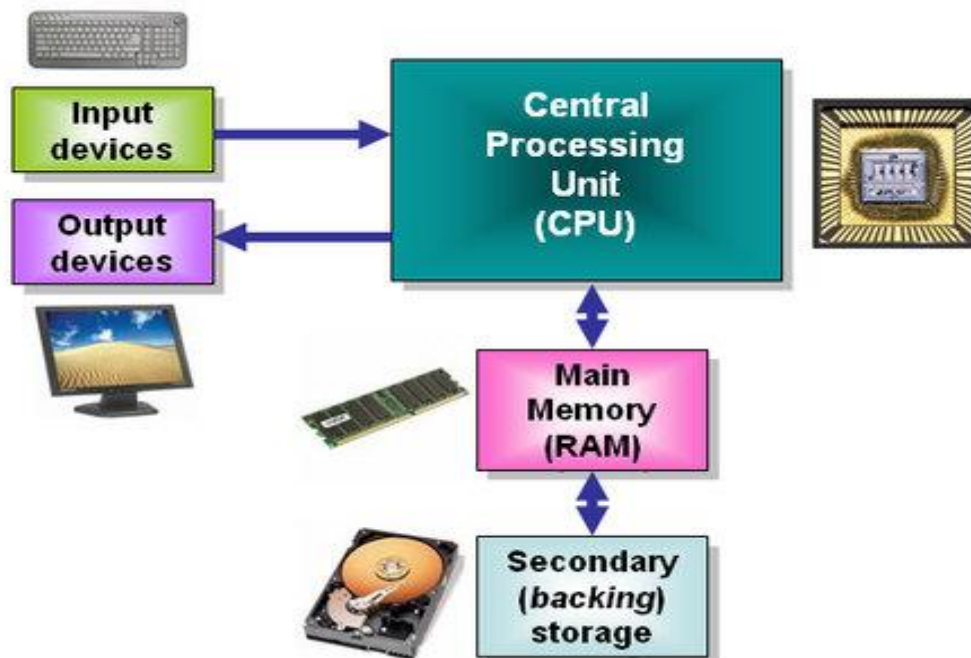
1. Personal Computer with, 4GB RAM, 500GB HDD, higher Processor
2. Software operating System
3. Antivirus.

Theory:

What is computer?

- A computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It is designed to execute applications and provides a variety of solutions by combining integrated hardware and software components.

Various parts of the computer system:-

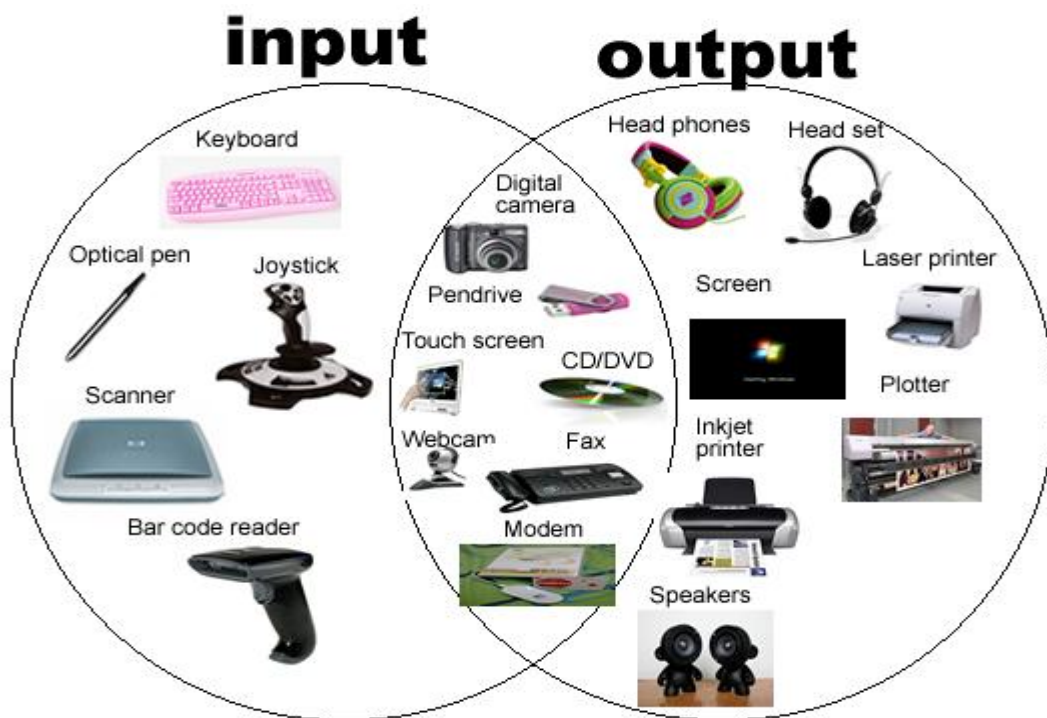


Input Unit:-

- Data and instructions must enter the computer system before any computation can be performed on the supplied data. The input unit that links the external environment with the computer system performs this task.
- It accepts (or reads) the list of instructions and data from the outside world.
- It converts these instructions and data in computer acceptable format.
- It supplies the converted instructions and data to the computer system for further processing.

List of Input devices:

- Keyboard.
- Image scanner.
- Microphone.
- Pointing device. Graphics tablet. Joystick. Light pen. Mouse. Optical. Pointing stick. Touchpad.
- Refreshable Braille display.
- Sound card.
- Webcam. Soft cam.
- Video card.



Output Unit:-

- The job of an output unit is just the reverse of that of an input unit. It supplied information and results of computation to the outside world. Thus it links the computer with the external environment.
- It accepts the results produced by the computer which are in coded form and hence cannot be easily understood by us.
- It converts these coded results to human acceptable (readable) form.
- It supplied the converted results to the outside world.

List of Input devices:

- Monitor (LED, LCD, CRT etc)
- Printers (all types)
- Plotters.
- Projector.
- LCD Projection Panels.
- Computer Output Microfilm (COM)
- Speaker(s)
- Head Phone.

Storage Unit:-

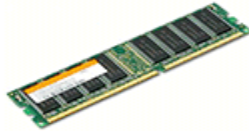
- The data and instructions that are entered into the computer system through input units have to be stored inside the computer before the actual processing starts. Similarly, the results produced by the computer after processing must also be kept somewhere inside the computer system before being passed on to the output units. Moreover, the intermediate results produced by the computer must also be preserved for ongoing processing.

Specific functions of the storage unit are

- All the data to be processed and the instruction required for processing (received from input devices).
- Intermediate results of processing.
- Final results of processing before these results are released to an output device.



Hard Disk



RAM



ROM



CD/DVD



Floppy



Memory Card



Pen Drive



Tape

Central Processing Unit (CPU):-

- The main unit inside the computer is the CPU. This unit is responsible for all events inside the computer. It controls all internal and external devices, performs "Arithmetic and Logical operations". The operations a Microprocessor performs are called "instruction set" of this processor.
- The control Unit and the Arithmetic and Logic unit of a computer system are jointly known as the Central Processing Unit (CPU). The CPU is the brain of any computer system.

Step by step assembling the personal computer:-

1. Prepare the Mainboard (motherboard). If you want to assemble the well-liked device, you should use Intel i3,i5,i7 Mainboard
2. Mount the CPU in the socket of the Mainboard. You must choose the correct CPU for your motherboard, and install it according to its instructions. Be careful not to install the CPU in wrong. Not only would your computer not work, it could short-circuit and damage your motherboard.
3. Connect the CPU cooler to the Mainboard.
4. Attach the RAM (memory) modules in the corresponding slots. The motherboard should have rows of slots that have 2 or 3 sections that are different lengths. Make sure the pins on the RAM cards line up with the pins on the motherboard connector. Don't get the RAM slots mixed up with PCI slots. The PCI slots are usually wider.
5. Open the case and mount the power supply, Make sure to connect all the connections to the drives and the motherboard.
6. Attach the Mainboard back plate to the case and check the Mainboard mounting positions.
7. Mount the Hard disk and connect it to the power supply and the motherboard. There should be separate connections for the power supply and the motherboard. In SATA Hard disk case, should remove the jumper
8. Connect the SATA connectors to the drives and the USB connectors and the case switches to the motherboard. The case and motherboard's instructions should tell where to connect the cables.

9. Mount the DVD-ROM drive. After connecting the ATA cable to the device, hook it up to the power supply.
10. Finally, select a compatible operating system, and follow the instructions to install.

Stepwise procedure to install operating system:-

1. Enter your computer's BIOS. Turn off the computer on which you want to install Windows 7 and then turn it back on. When the BIOS screen appears or you are prompted to do so, press **Del**, **Esc**, **F2**, **F10**, or **F9** (depending on your computer's motherboard) to enter the system BIOS. The key to enter the BIOS is usually shown on the screen.
2. Find your BIOS's boot options menu. The boot options menu of your BIOS may vary in location or name from the illustration, but you may eventually find it if you search around. If you can't find the boot options menu, search the name of your BIOS (most likely located in the BIOS menu) online for help.
3. Select the CD-ROM drive as the first boot device of your computer. Although this method may vary among computers, the boot options menu is typically a menu of movable device names where you should set your CD-ROM drive as the first boot device. It can also be a list of devices that you can set the order of their boot on. Consult a manual or the internet for help if you're stuck.
4. Save the changes of the settings. Press the button indicated on the screen or select the save option from the BIOS menu to save your configuration.
5. Shut off your computer. Either turn off the computer by choosing the shut-down option in your current operating system, or hold the power button until the computer powers off.
6. Power on the PC and the insert the operating disc into your CD/DVD drive.
7. Start your computer from the disc. After you have placed the disc into the disc drive, start your computer. When the computer starts, press a key if you are asked if you would like to boot from the disc by pressing any key
8. Choose your Windows Setup options. Once Windows Setup loads, you'll be presented with a window. Select your preferred language, keyboard type, and time/currency format, and then click Next.
9. Click the Install Now button.
10. Accept the License Terms. Read over the Microsoft Software License Terms, check I accept the license terms, and click Next.
11. Decide on which hard drive and partition you want to install Windows on. A hard drive is a physical part of your computer that stores data, and partitions "divide" hard drives into separate parts.
12. Install Windows on your preferred hard drive and partition. Once you've decided on where to install Windows, select it and click Next. Windows will begin installing.

What is Antivirus?:-

- Antivirus software is a type of program designed and developed to protect computers from malware like viruses, computer worms, spyware, botnets, rootkits, keyloggers and such. Antivirus programs function to scan, detect and remove viruses from your computer. There are many versions and types of anti-virus programs that are on the market.

Stepwise procedure to install Antivirus on personal computer:-

1. If you purchased the antivirus program from a retail store, insert the CD or DVD into the computer's disc drive, Or If you downloaded the antivirus program on the Internet, find the downloaded file on your computer.
2. Look for a file *named setup.exe, install.exe, or something similar*, and then double-click that file. The installation process should start, with a window opening to help guide you through the install process.
3. In the installation process window, follow the steps provided to install the antivirus program. The install process will provide recommended options so the antivirus program will function properly, which in most cases can be accepted as yes.
4. When the install process is complete, close out of the install window.
5. Remove the CD or DVD from the computer's disc drive, The antivirus program is now installed and ready to use.

Conclusion:-

Questions:-

1. Define the computer, state its applications.
2. List the various components of computer system.
3. What is function of CPU and memory in computer system?
4. What are functions of input and output devices?
5. State why antivirus needed for a computer?
6. List out different antivirus of different companies.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 14

Aim: Troubleshoot the domestic water level controller.

Apparatus:-

1. Domestic water level circuit.
2. Digital multimeter
3. Connecting wires.

Theory:

What is water level controller?

- Automatic water-level controller for overhead tanks that switches on/off the pump motor when water in the tank goes below/above the minimum/maximum level. The water level is sensed by two floats to operate the switches for controlling the pump motor.

The Advantages of Water Level Controller:-

1. Saves Power

- Using a water level controller saves power. This is because water levels are controlled automatically, which limits the amount of electricity used.

2. Saves Money

- Since a water level controller conserves power, it saves money, as well. Basically, water regulation is optimized through these devices, which means that wasted electricity and wasted water is kept at a minimum. That saves a substantial amount of money over time.

3. Works Automatically

- Another big advantage is that these devices can work on their own. Thanks to timer switches, there is no need to operate them manually. This means that the frustrations involved with monitoring something like a water tank is minimized, and the water levels will be where they should be.

4. Maximizes Water

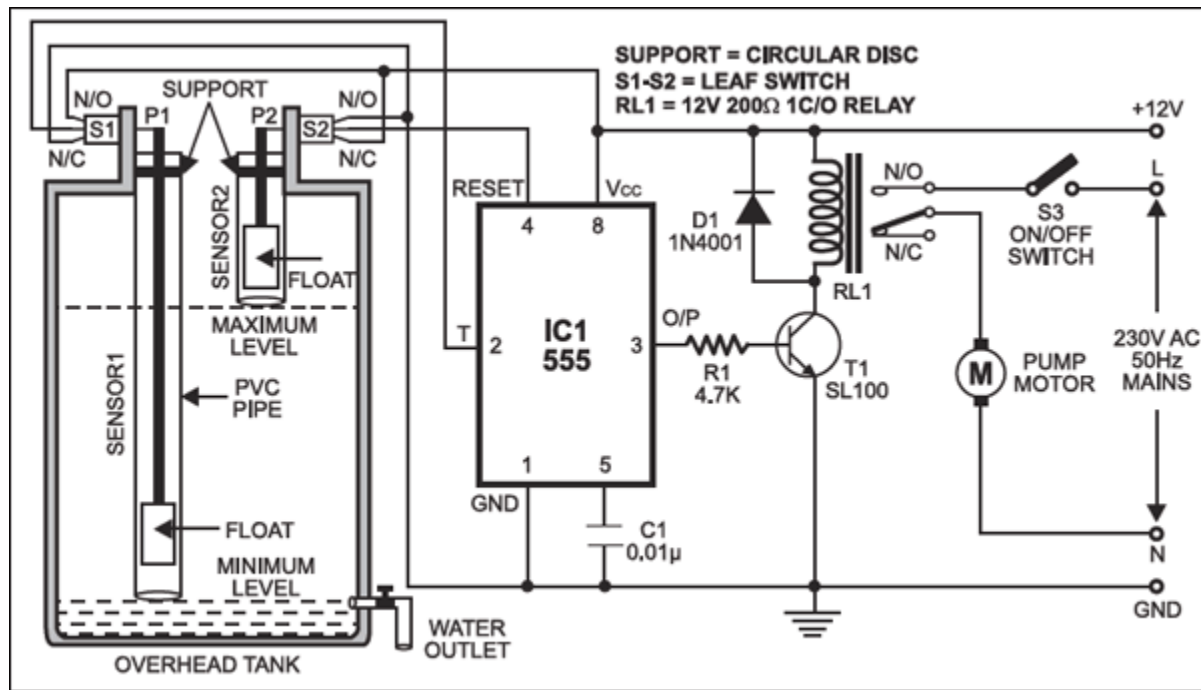
- A water level controller is helpful because it automatically provides more water during the middle of the day and less water at night. As a result, water remains at its appropriate level at all times.

Methods of water level controller:-

- Optical
- Vibrating or tuning fork
- Ultrasonic
- Float
- Capacitance
- Radar
- Conductivity or resistance

Automatic water-level controller circuit:-

Each sensors float is suspended from above using an aluminum rod. This arrangement is encased in a PVC pipe and fixed vertically on the inside wall of the water tank. Such sensors are more reliable than induction-type sensors. Sensor 1 senses the minimum water level, while sensor 2 senses the maximum water level.



Leaf switches S1 and S2 (used in tape recorders) are fixed at the top of the sensor units such that when the floats are lifted, the attached. Leaf switches S1 and S2 (used in tape recorders) are fixed at the top of the sensor units such that when the floats are lifted, the attached.

Circuit operation:-

- When water in the tank goes below the minimum level, moving contacts (P1 and p2) of both leaf switches will be in N/ C position. That means trigger pin 2 and reset pin4 of IC1 are connected to ground and 12V, respectively. This triggers IC1 are connected to ground and 12V, respectively. This triggers IC1 and its output goes high to energise relay RL1 through driver transistor [SL100](#) (T1). The pump motor is switched on and it starts pumping water into the overhead tank if switch S3 is 'on'.
- As the water level in the tank rises the float of sensor 1 goes up. This shifts the moving contact of switch S1 to N/O position and trigger pin 2 of IC1 gets connected to 12V . This doesn't have any impact on IC1 and its output remains high to keep the pump motor running.
- As the water level rises further to reach the maximum level, the float of sensor 2 pushes the moving contact of S2 to N/O position and it gets connected to ground. Now IC1 is reset and its output goes low to switch the pump off.
- As is consumed , its level in the overhead tank goes down. Accordingly, at is consumed, its level in the overhead tank goes down. Accordingly, the float of sensor 2 also goes down. This causes the moving contact of switch S2 to shift back to NC position and reset pin 4 of IC1 is again connected to 12V. But IC1 doesn't get triggered because its trigger pin 2 is still clamped to 12V by switch S1. So the pump remains switched off.
- When water level further goes down to reach the minimum level, the moving contact of switch S1 shifts back to N/C position to connect trigger pin 2 of IC1 to ground. This triggers IC1 and the pump is switched on.

Actual Circuit diagram of water level controller in laboratory:-

Stepwise Procedure:-

1. Do the physical observations of different section of water level controller.
2. Draw the circuit diagram of the given water level controller and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage at all the check points in the table.
5. Compare the voltage value at given point with expected value, and then identify the fault in given water level controller circuit.

Observation table:

Sr.No.	Check point	Measured value	Excepted value

Mention the different faults in troubleshooting of given water level controller:-

- 1.
- 2.
- 3.

Conclusion:-

Questions:-

1. What is water level controller?
2. State the need of water level controller in industrial and domestic purpose.
3. Write different applications of water level controller.
4. List out different water level sensors.
5. State different methods of water level control.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 15

Aim : Troubleshoot the Electronic weighing machine.

Apparatus:-

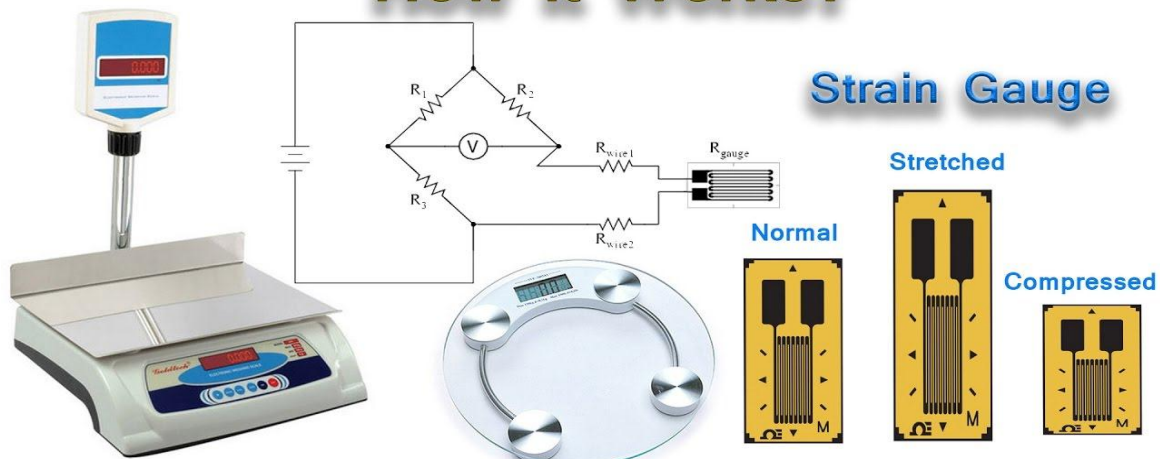
1. Electronic weighing machine.
2. Digital multimeter
3. Connecting wires.

Theory:

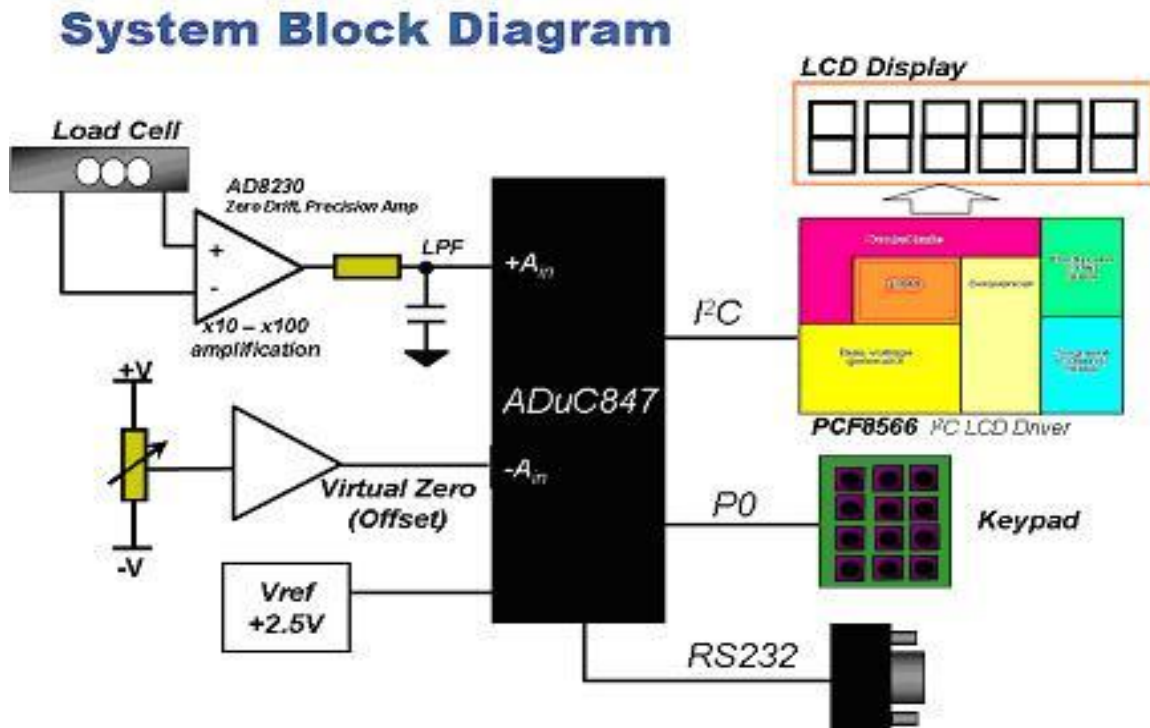
What is Weighing machine:-

- A weighing scale (or weighing balance) is devices to measure weight or mass. They are also known as mass scales, weight scales, mass balance, weight balance, or simply scale, balance, or balance scale.
- Electronic digital scales display weight as a number, usually on a liquid crystal display (LCD). They are versatile because they may perform calculations on the measurement and transmit it to other digital devices. In a digital scale, the force of the weight causes a spring to deform, and the amount of deformation is measured by one or more transducers called strain gauges. A strain gauge is a conductor whose electrical resistance changes when its length changes.

Digital Weighing Machine How it Works?

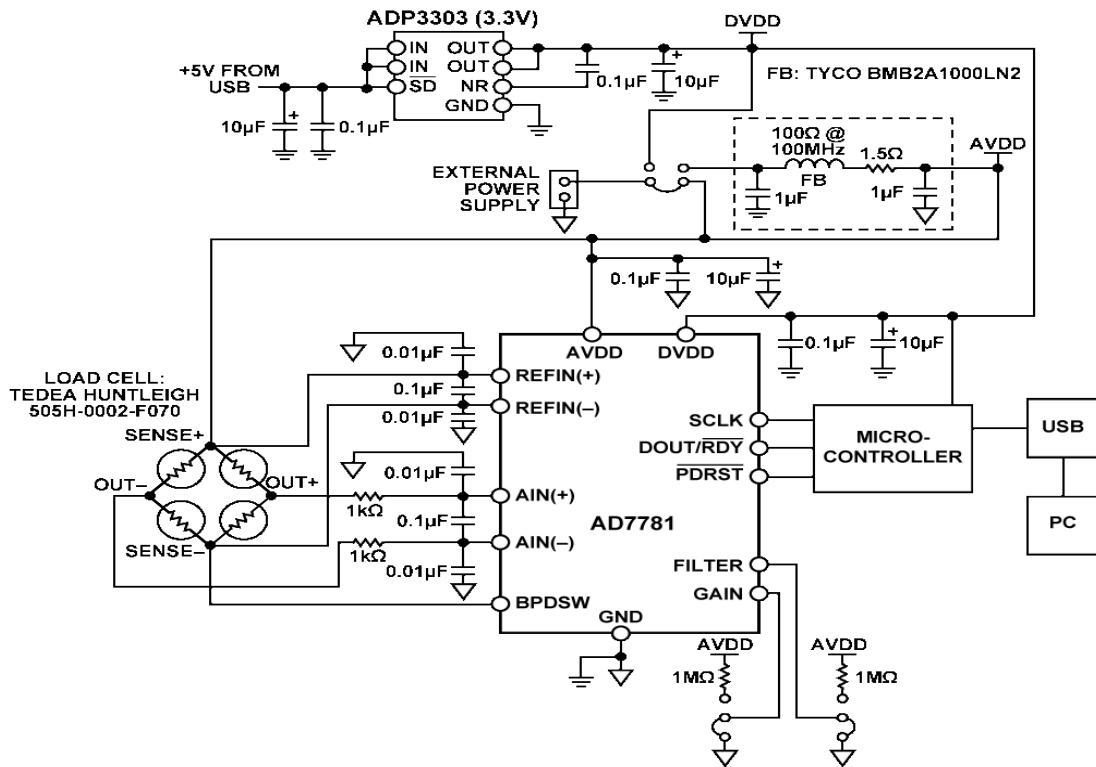


- Strain gauges have limited capacity and larger digital scales may use a hydraulic transducer called a load cell instead. A voltage is applied to the device, and the weight causes the current through it to change. The current is converted to a digital number by an analog-to-digital converter, translated by digital logic to the correct units, and displayed on the display. Usually the device is run by a microprocessor chip.



- That is a typical load cell arranged in a wheat stone bridge format. The output is clubbed into 4 wires. The load is applied at the free end. The strain gauges are applied on all 3 sides to pick up compression and expansions which is nothing but load signal which is processed and measured for weight measurements. The color code of the 4 wires that comes of it has uniform meaning – Red, white, black & green.
- If you look at the load cell, it has strain gauge attached on all three side with suitable strain relieving frames in-built with the design. Put some thick washer and then tight it with the base plate and the load plate so that the strain gauges are free from rubbing with the base plate as well as the load plate.

Sample circuit diagram:-



CIRCUIT FUNCTION AND BENEFITS:-

- This circuit is a weigh scale system that uses the AD7781. The AD7781 is a pin programmable, low power, low drift 20-bit Σ - Δ converter that includes a PGA and uses an internal clock. Therefore, the device simplifies the weigh scale design since most of the system building blocks are included on the chip. The device consumes only 330 μ A typically and is, therefore, suitable for any low power or battery application. The AD7781 also has a power-down mode that allows the user to switch off the power to the bridge sensor and power down the AD7781 when not converting, thus increasing the battery life.

Actual Circuit diagram of electronic Weighing machine in laboratory:-

Stepwise Procedure:-

1. Do the physical observations of different section of electronic weighing machine.
2. Draw the circuit diagram of the given electronic weighing machine and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage at all the check points in the table.
5. Compare the voltage value at given point with expected value, and then identify the fault in given electronic weighing machine circuit.

Observation table:

Sr.No.	Check point	Measured value	Excepted value

Mention the different faults in troubleshooting of given electronic weighing machine:-

- 1.
- 2.
- 3.

Conclusion:-

Questions:-

1. What is Weighing machine?
2. State working principle of digital weighing machine.
3. State which type of transducer used in digital weighing machine?
4. State working principle of strain gauge.
5. State different types of strain gauges.
6. List the different materials used to construct the strain gauge.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 16

Aim: Troubleshoot the Emergency light system.

Apparatus:-

1. Emergency light system trainer.
2. Digital multimeter
3. Connecting wires.

Theory:

What is Emergency light system?

- An emergency light is a battery-backed lighting device that switches on automatically when a building experiences a power outage. Emergency lights are standard in new commercial and high occupancy residential buildings, such as college dormitories, apartments, and hotels. Most building codes require that they be installed in older buildings as well.
- Modern emergency lighting is installed in virtually every commercial and high occupancy residential building. The lights consist of one or more incandescent bulbs or one or more clusters of high-intensity light-emitting diodes (LED). The emergency lighting heads are usually either PAR 36 sealed beams or wedge base lamps.



A small emergency light

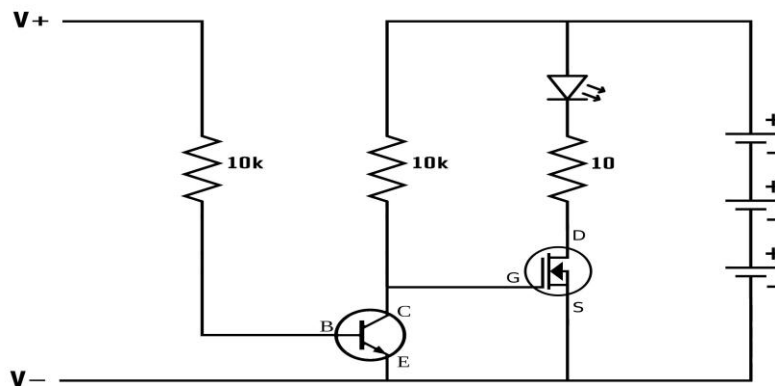


Modern Emergency Light Design.

Emergency light installation:-

- The emergency lighting heads are usually either PAR 36 sealed beams or wedge base lamps. All units have some sort of a device to focus and intensify the light they produce. This can either be in the form of a plastic cover over the fixture, or a reflector placed behind the light source. Most individual light sources can be rotated and aimed for where light is needed most in an emergency, such as toward fire exits.
- Modern systems are operated with relatively low voltage, usually from 6-12 volts. This both reduces the size of the batteries required and reduces the load on the circuit to which the emergency light is wired.

Sample Emergency light system circuit:-



Circuit working:-

- A DC power supply is hooked up on the left side of the circuit with the positive terminal connected to the resistor and the negative terminal connected to the common ground. The signal from the power supply goes through the resistor to the base of an NPN transistor. This activates the transistor and effectively shorts the gate pin of the MOSFET to ground. This keeps the gate pin in a LOW state and the MOSFET will not conduct electricity, so the LEDs are off.
- When the signal from the power supply is turned off (such as in a blackout), the states reverse. With no signal at the base pin, the NPN transistor turns off and is no longer connecting the MOSFET gate pin to ground. The voltage of the gate pin is now pulled HIGH through the 10k resistor. The MOSFET will now conduct electricity and connects the LEDs to ground. The LEDs turn on.

- As long as the grid power is connected, the LEDs are off. But as soon as the power goes out, the LEDs automatically turn on. The power for the LEDs is supplied by three AAA batteries. In this configuration, the lights can stay on for up to 10 hours.

Actual Circuit diagram of Emergency light system in laboratory:-

Stepwise Procedure:-

1. Do the physical observations of different section of Emergency light system.
2. Draw the circuit diagram of the given Emergency light system and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage at all the check points in the table.
5. Compare the voltage value at given point with expected value, and then identify the fault in given electronic Emergency light system circuit.

Observation table:

Sr.No.	Check point	Measured value	Excepted value

Mention the different faults in troubleshooting of given Emergency light system:-

- 1.
- 2.
- 3.

Conclusion:-

Questions:-

1. What is Emergency light system?
2. State the need of emergency light system.
3. List out different components of emergency light system.
4. List advantages of emergency light system.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 17

Aim: Troubleshoot the Photovoltaic solar panel power system.

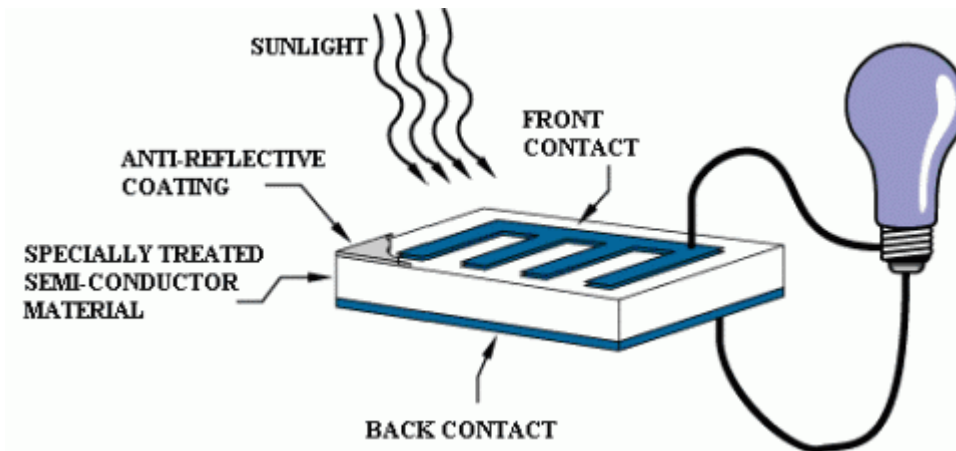
Apparatus:-

1. Photovoltaic solar panel power trainer.
2. Digital multimeter, CRO
3. Connecting wires.

Theory:

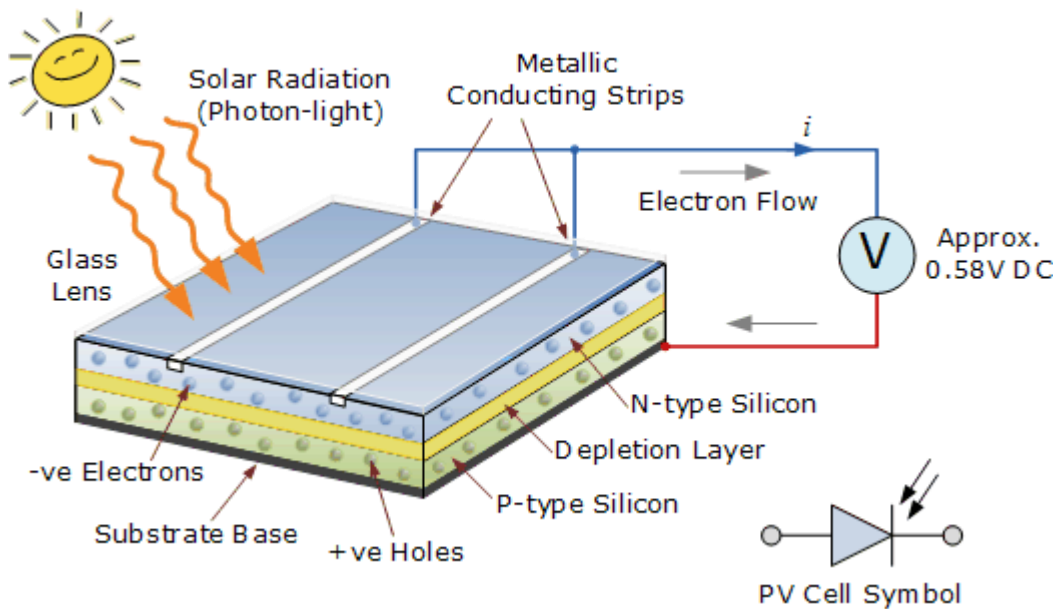
What is Photovoltaic?

- Photovoltaic is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, electric current results that can be used as electricity.

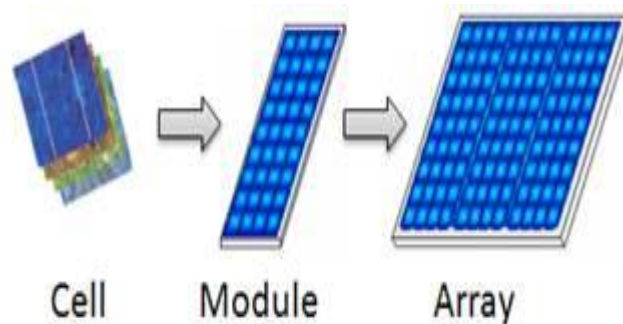


A solar cell:-

- A solar cell is a solid-state electrical device (p-n junction) that converts the energy of light directly into electricity (DC) using the photovoltaic effect. The process of conversion first requires a material which absorbs the solar energy (photon), and then raises an electron to a higher energy state, and then the flow of this high-energy electron to an external circuit. Silicon is one such material that uses such process.



A Solar Cell Structure



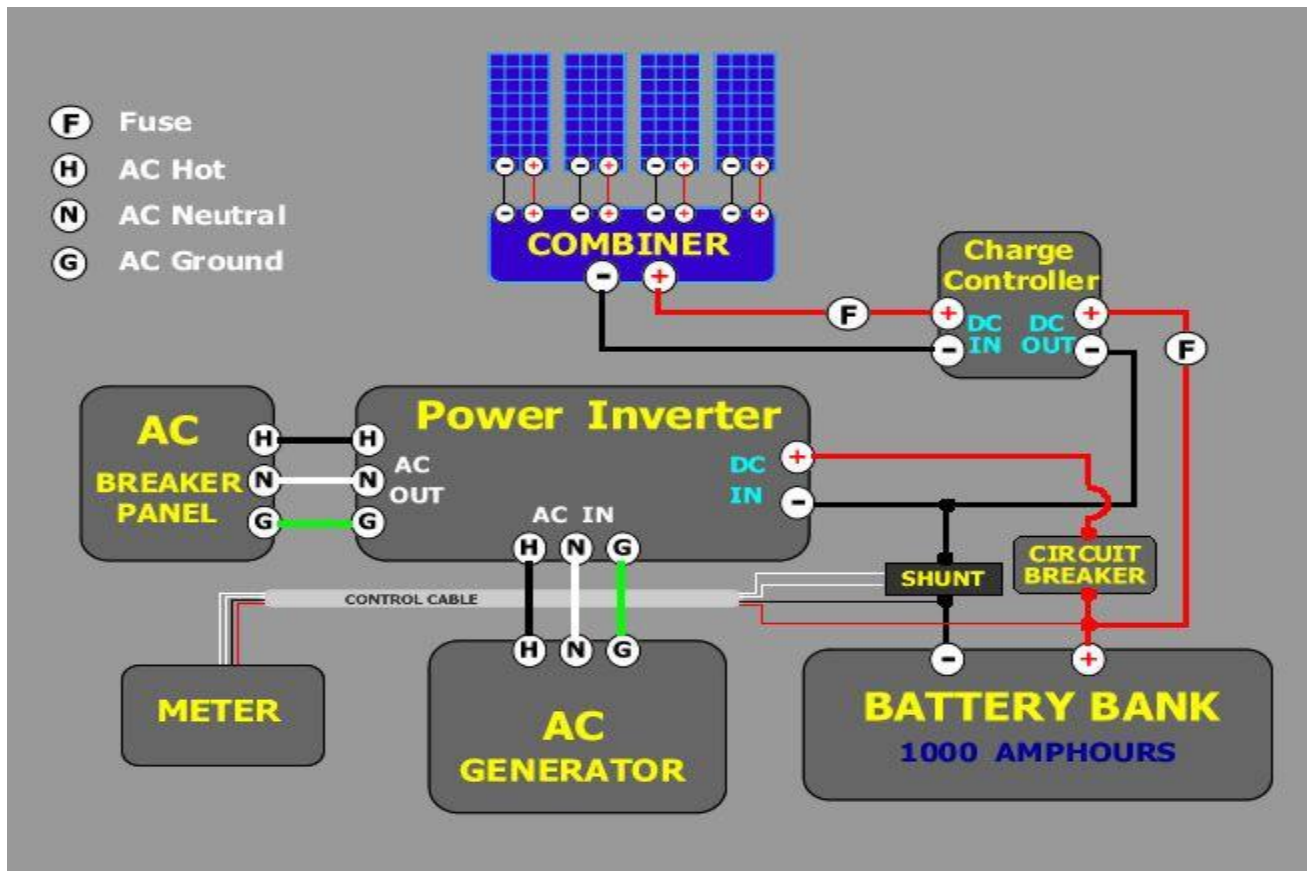
Solar Panel Configuration

- Photovoltaics are silicon semiconductor devices similar in many ways to electronic diodes and transistors. Photovoltaic's produce electricity by converting the solar energy generated from the sun in the form of either visible light, ultra-violet (UV) radiation or infra-red (IR) radiation into a direct or DC current by using the photovoltaic action of the cell without the use of any moving parts.

Applications:-

- Photovoltaic power stations
- Rooftop solar PV systems
- Standalone PV systems
- Solar hybrid power systems
- Concentrated Photovoltaics
- Solar planes
- Solar-pumped lasers
- Solar vehicles
- Solar panels on spacecrafts.

Sample Photovoltaic wiring diagram:-



- A photovoltaic system for residential, commercial, or industrial energy supply consists of the solar array and a number of components often summarized as the balance of system (BOS). This term is synonymous with "Balance of plant" BOS-components include power-conditioning equipment and structures for mounting, typically one or more DC to AC power converters, also known as inverters, an energy storage device, a racking system that supports the solar array, electrical wiring and interconnections, and mounting for other components.
- The amount of current generated by photon excitation in a PV cell at a given temperature is affected by incident light in two ways:
 1. By the intensity of the incident light.
 2. By the wavelength of the incident rays.
- PV cells can be arranged in a series configuration to form a module, and modules can then be connected in parallel-series configurations to form arrays. When connecting cells or modules in series, they must have the same current rating to produce an additive voltage output, and similarly, modules must have the same voltage rating when connected in parallel to produce larger currents.

Actual Circuit diagram of Emergency light system in laboratory:-

Stepwise Procedure:-

1. Do the physical observations of different section of the Photovoltaic solar panel power system.
2. Draw the circuit diagram of the given the Photovoltaic solar panel power system and mark the test points.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage at all the check points in the table.
5. Compare the voltage value at given point with expected value, and then identify the fault in given the Photovoltaic solar panel power system.

Observation table:

Sr.No.	Check point	Measured value	Excepted value

Mention the different faults in troubleshooting of given Emergency light system:-

- 1.
- 2.
- 3.

Conclusion:-

Questions:-

1. State the working principle of Photovoltaic cell.
2. List out different applications of Photovoltaic cell.
3. List the different components of Photovoltaic solar panel power system.
4. State different materials used to construct Photovoltaic cell.
5. List advantages of Photovoltaic solar panel power system

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 18

Aim: Create new file using given EDA tool to develop the layout regulated power supply circuit.

Apparatus: EDA software tool PROTEUS

Theory:

EDA :

Electronic design automation (EDA), also referred to as electronic computer-aided design (ECAD), is a category of software tools for designing electronic systems such as integrated circuits and printed circuit boards. The tools work together in a design flow that chip designers use to design and analyze entire semiconductor chips. Since a modern semiconductor chip can have billions of components, EDA tools are essential for their design.

Proteus :

Proteus is a simulation and design software tool developed by Labcenter Electronics for Electrical and Electronic circuit design. It also possess 2D CAD drawing feature. It deserves to bear the tagline “From concept to completion”.

About Proteus

It is a software suite containing schematic, simulation as well as PCB designing.

- ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.
- ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.
- The designer can also develop 2D drawings for the product.

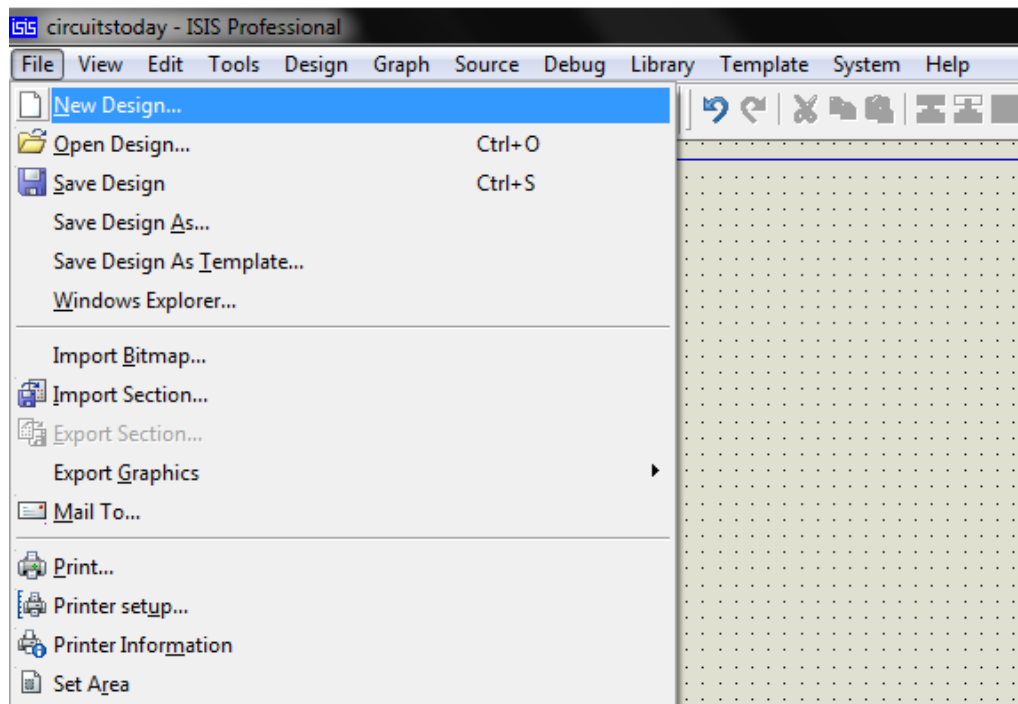
Features

ISIS has wide range of components in its library. It has sources, signal generators, measurement and analysis tools like oscilloscope, voltmeter, ammeter etc., probes for real time monitoring of the parameters of the circuit, switches, displays, loads like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog Integrated circuits, semi-conductor switches, relays, microcontrollers, processors, sensors etc.

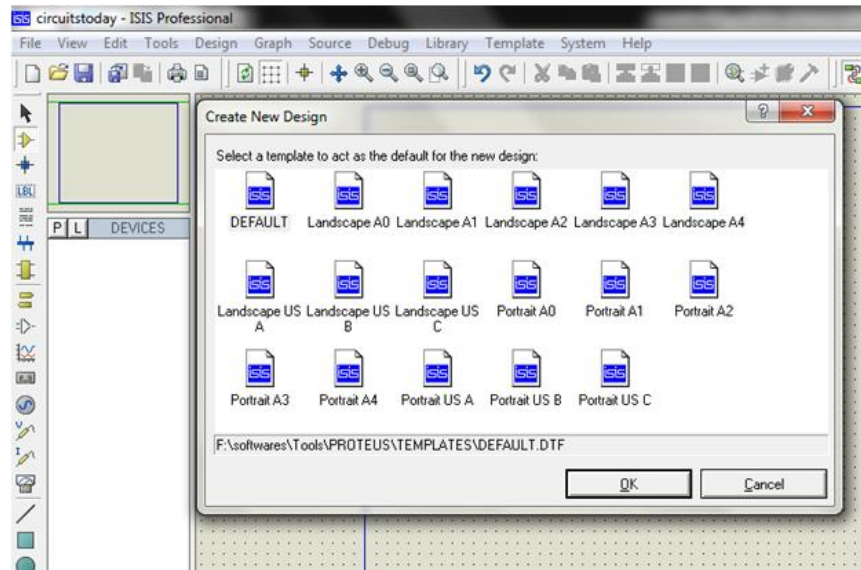
ARES offers PCB designing up to 14 inner layers, with surface mount and through hole packages. It is embedded with the foot prints of different category of components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB Designer. The schematic drawn in the ISIS can be directly transferred ARES.

Starting New Design

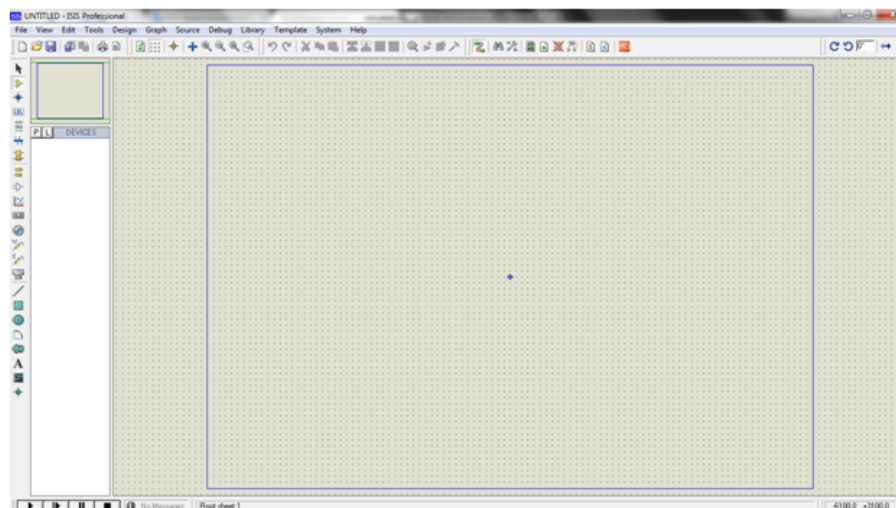
Step 1: Open ISIS software and select New design in File menu



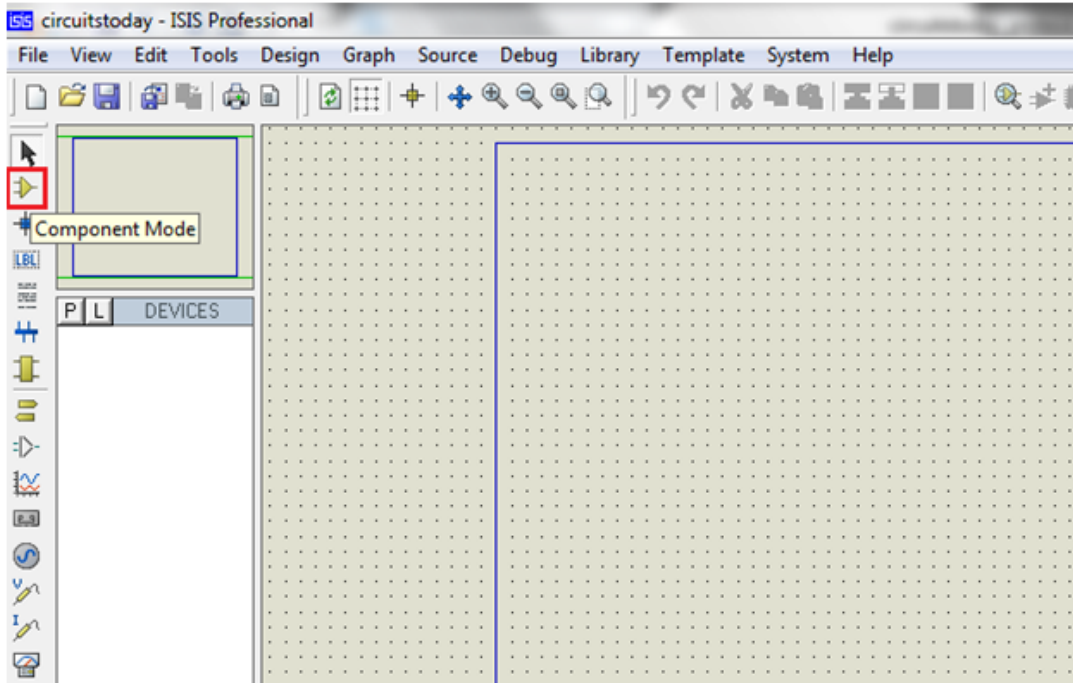
Step 2: A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.



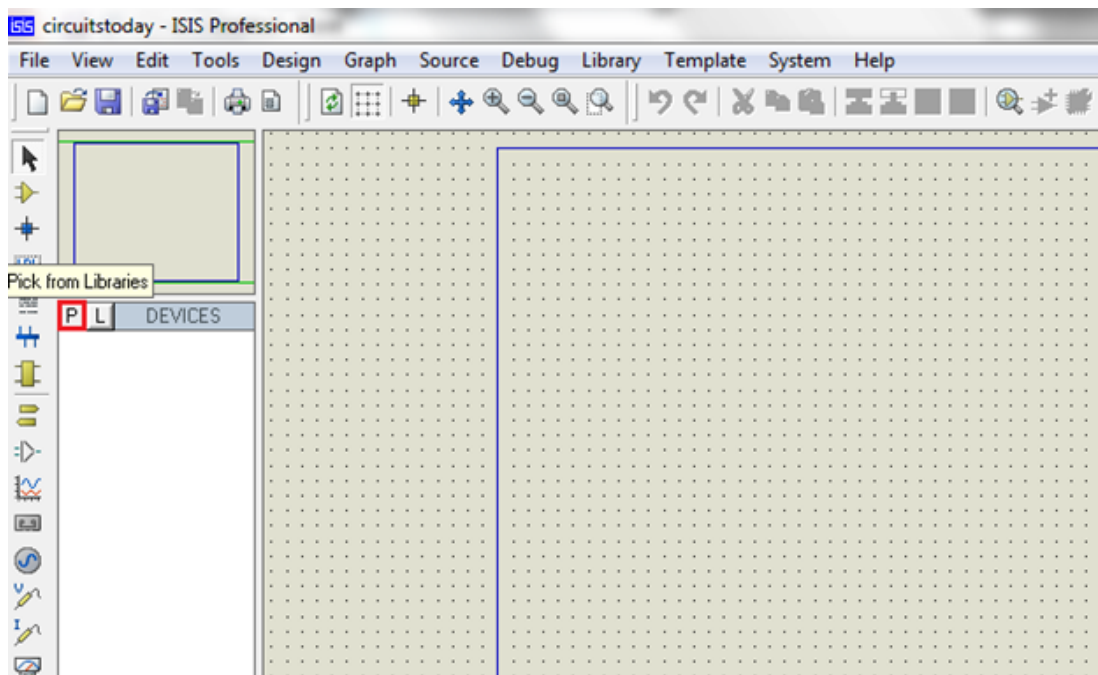
Step 3: An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.



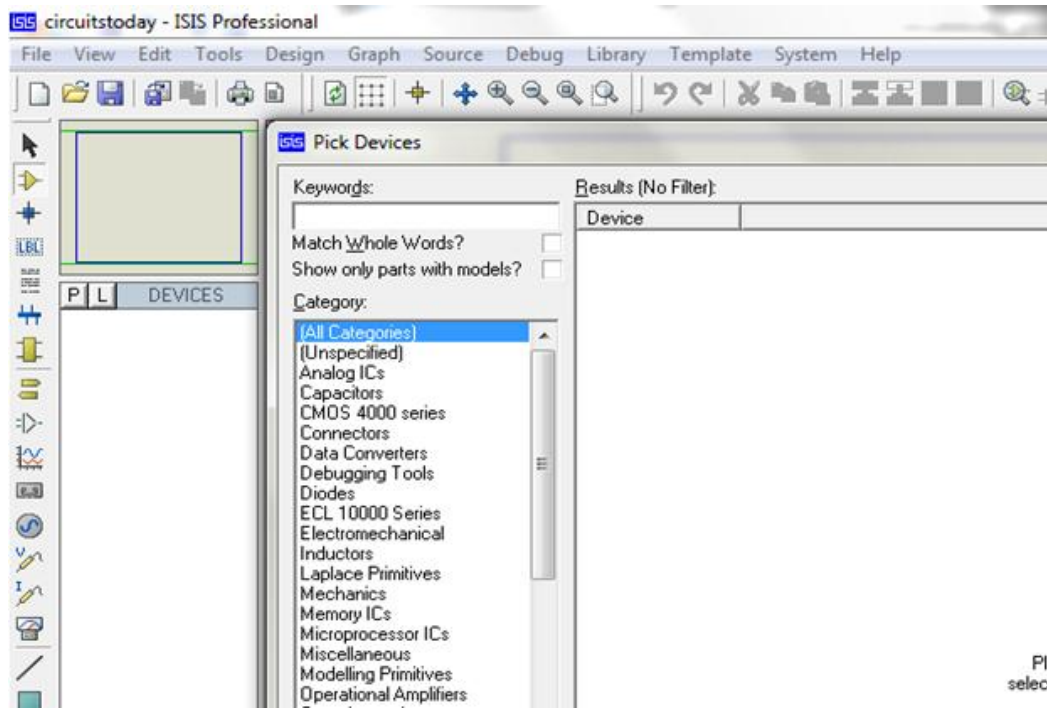
Step 4: To Select components, Click on the component mode button.



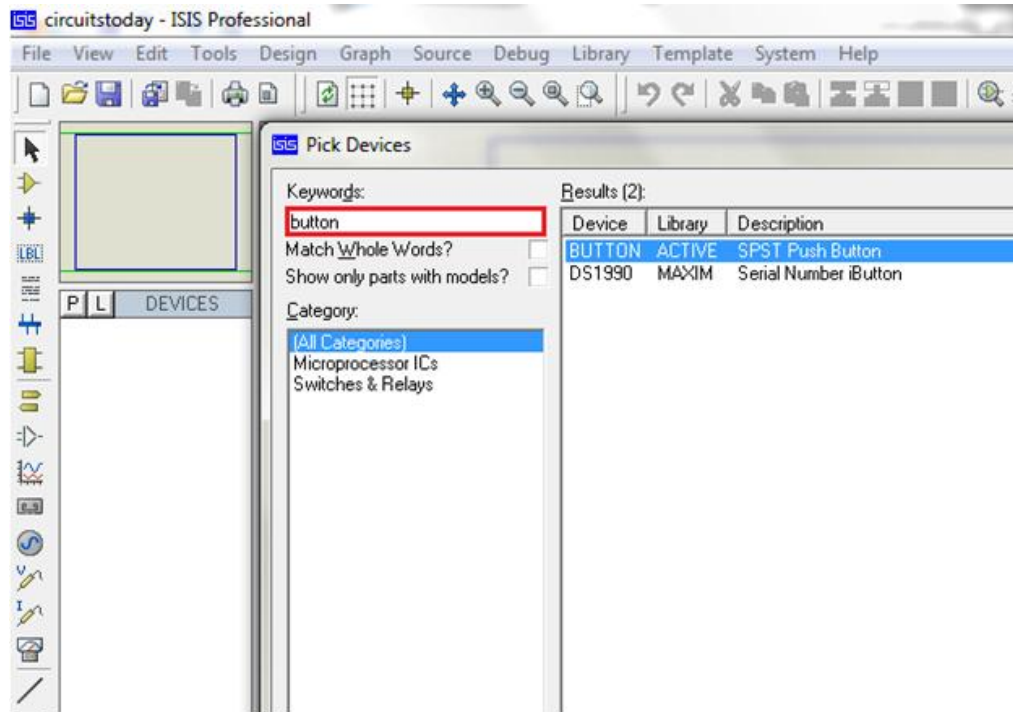
Step 5: Click on Pick from Libraries. It shows the categories of components available and a search option to enter the part name.



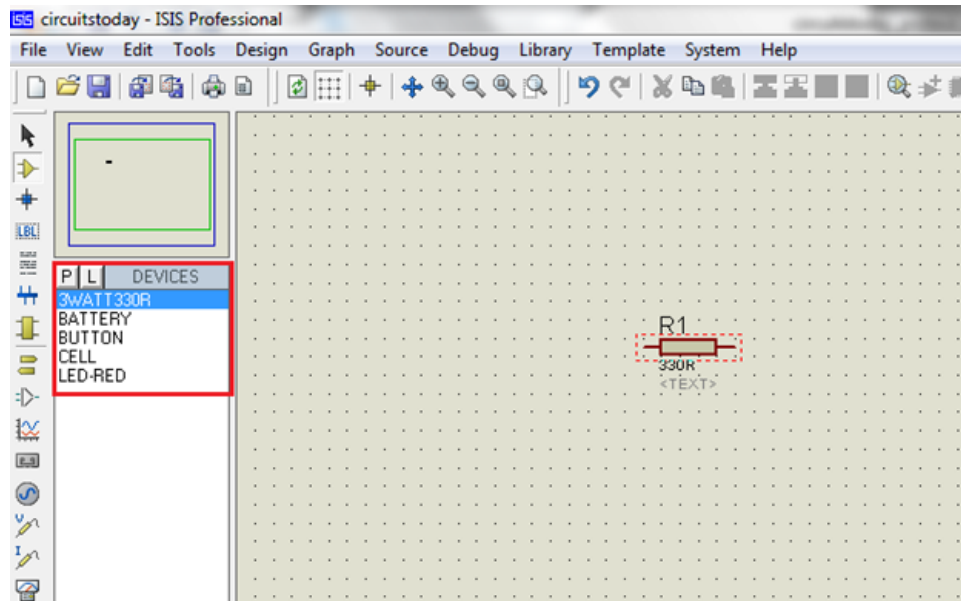
Step 6: Select the components from categories or type the part name in Keywords text box.



Example shows selection of push button. Select the components accordingly.

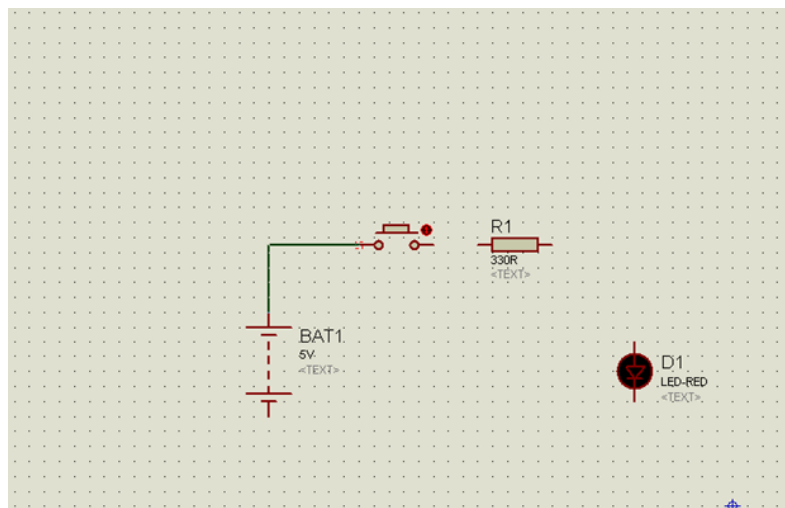


Step 7: The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.

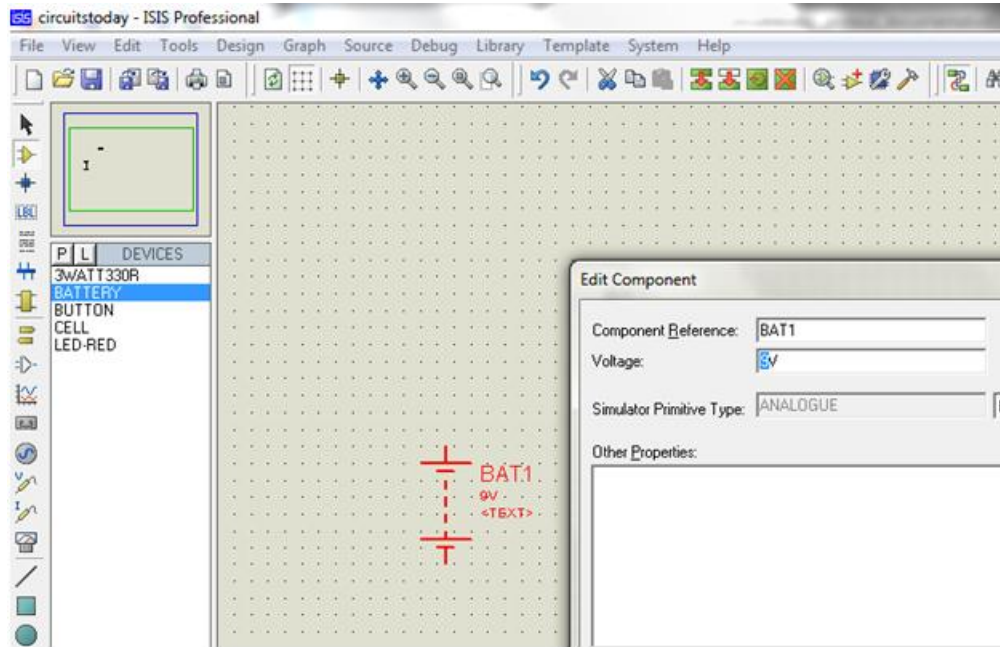


Place all the required components and route the wires i.e, make connections.

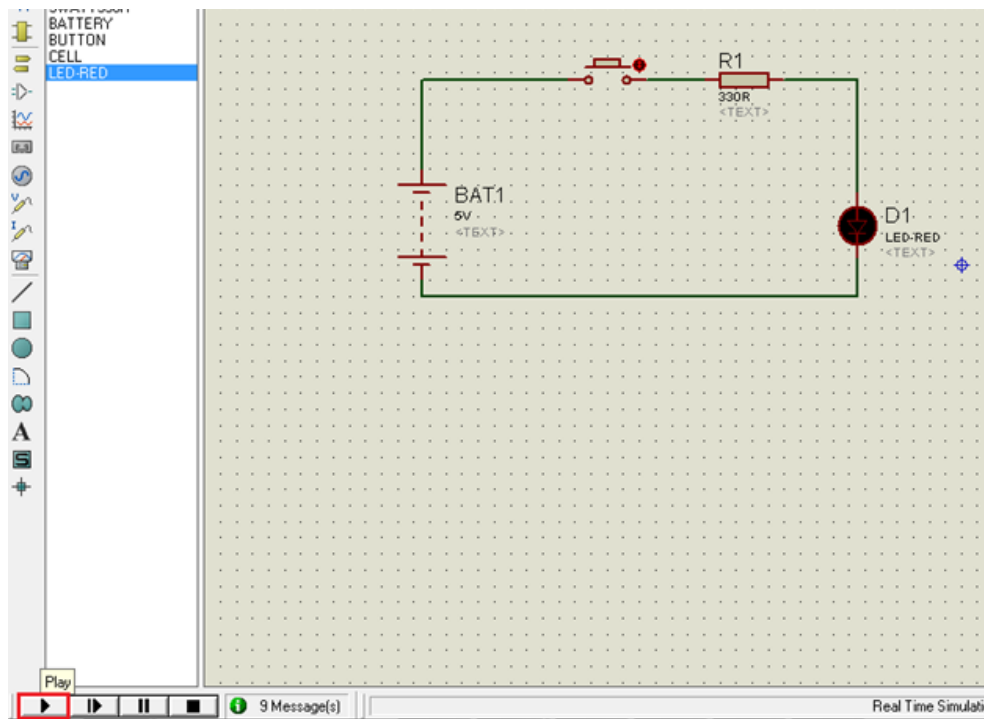
Either selection mode above the component mode or component mode allows to connect through wires. Left click from one terminal to other to make connection. Double right-click on the connected wire or the component to remove connection or the component respectively.



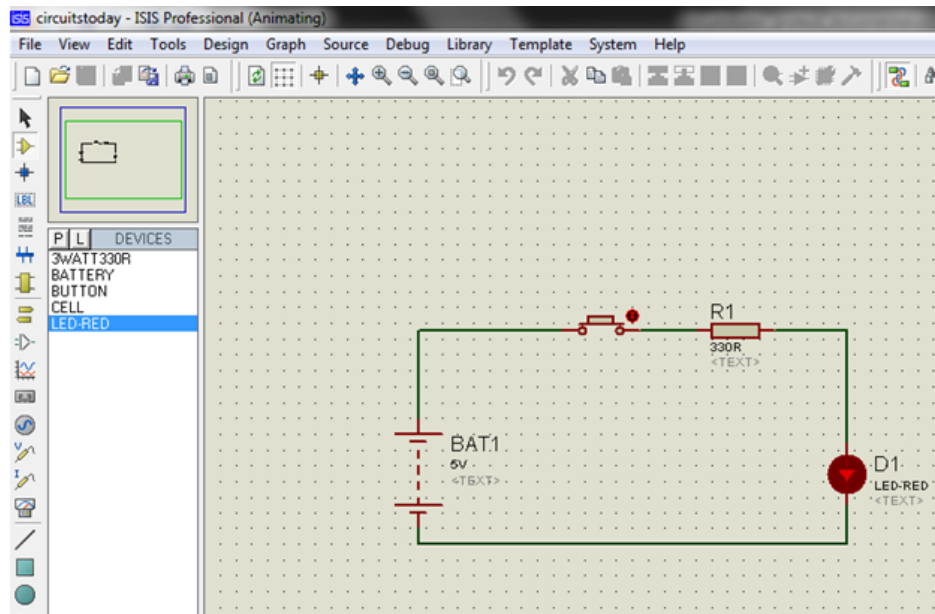
Double click on the component to edit the properties of the components and click on Ok.



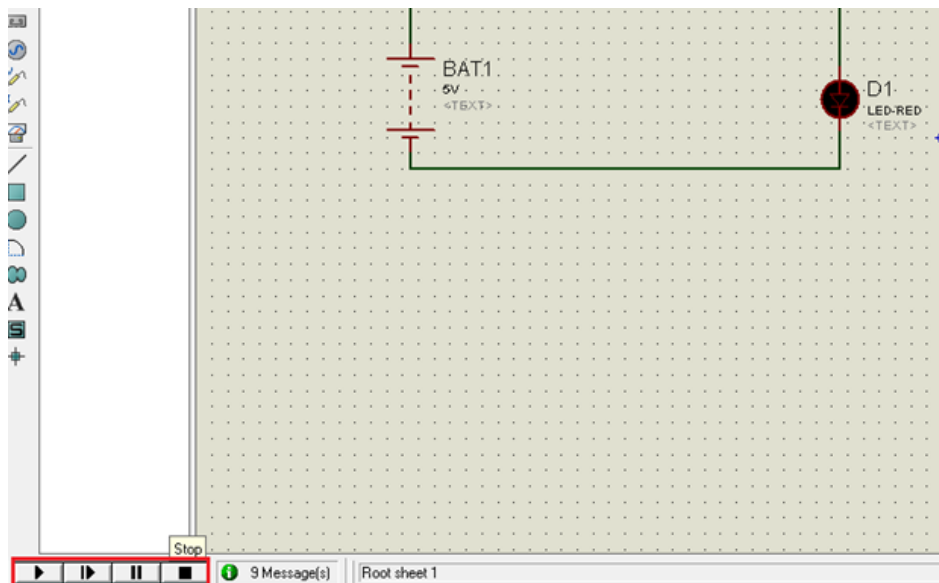
Step 8: After connecting the circuit, click on the play button to run the simulation.



In this example simulation, the button is depressed during simulation by clicking on it to make LED glow.



Simulation can be stepped, paused or stopped at any time.



Conclusion:

Questions:-

1. State the features of EDA software tool PROTEUS.
2. List out the different EDA software tools.
3. Define load regulation and line regulation.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 19

Aim: Measure the dc current and dc voltage of the given circuit using node analysis through EDA simulation tool.

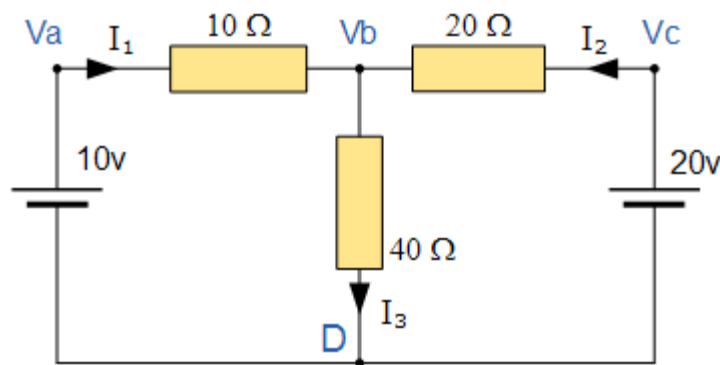
Apparatus: EDA software tool PROTEUS

Theory:

Node analysis:-

- The main concept behind the nodal analysis is that, in a given circuit if the node voltages are known, then we can immediately determine all branch currents associated with the circuit. As we know that, for finding node voltages we use KCL. In this technique, node voltages are considered as variables in the circuit, instead of element voltages, which results in reduction of the number of equations to simplify the circuit. In nodal analysis method.
- Nodal Voltage Analysis finds the unknown voltage drops around a circuit between different nodes that provide a common connection for two or more circuit components.

Nodal Voltage Analysis Circuit example:-



In the above circuit, node D is chosen as the reference node and the other three nodes are assumed to have voltages, Va, Vb and Vc with respect to node D. For example;

$$\frac{(V_a - V_b)}{10} + \frac{(V_c - V_b)}{20} = \frac{V_b}{40}$$

As $V_a = 10\text{v}$ and $V_c = 20\text{v}$, V_b can be easily found by:

$$\left(1 - \frac{V_b}{10}\right) + \left(1 - \frac{V_b}{20}\right) = \frac{V_b}{40}$$

$$2 = V_b \left(\frac{1}{40} + \frac{1}{20} + \frac{1}{10}\right)$$

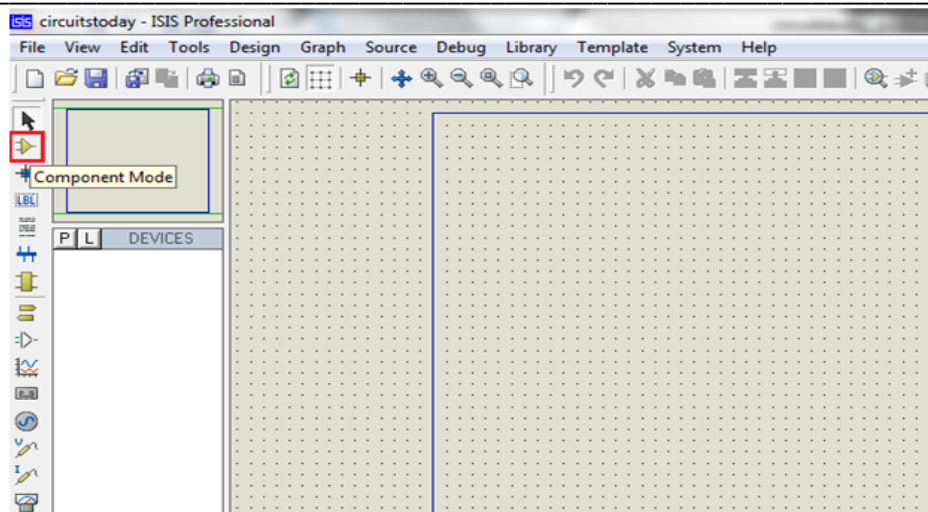
$$V_b = \frac{80}{7} \text{ V}$$

$$\therefore I_3 = \frac{2}{7} \text{ or } 0.286 \text{ Amps}$$

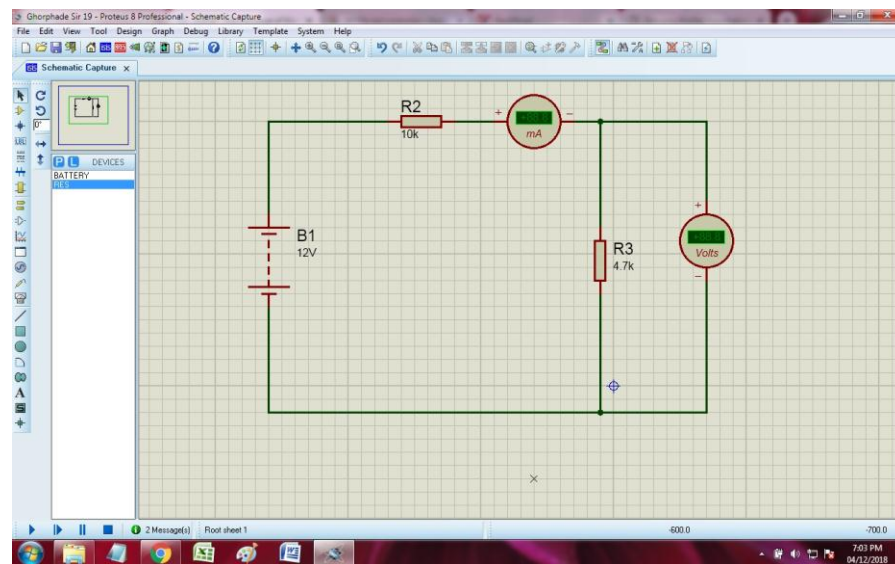
Actual Circuit diagram for simulation:-

Stepwise procedure to simulate the circuit through EDA tool Proteus:-

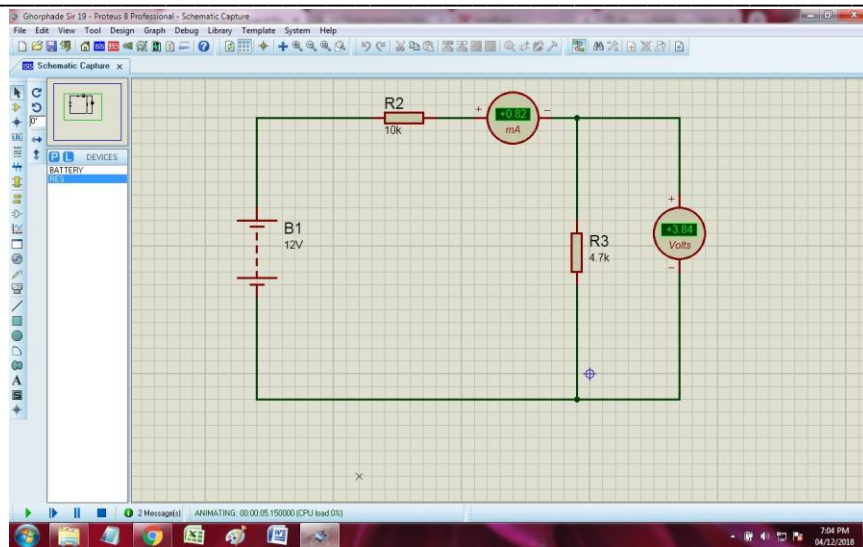
1. Open ISIS software and select New design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To Select components, Click on the component mode button.



5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.
7. Connect the as per circuit.



8. Click on the play button to run the simulation



9. Compare the theoretical and simulation result.

Conclusion:-

Questions:-

1. State ohm's law.
2. State Kirchhoff's voltage and current law.
3. List different EDA software tools.
4. State law applicable for nodal analysis.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 20

Aim: Simulate /Test half wave rectifier circuit using EDA tool.

Apparatus: EDA software tool PROTEUS

Theory:

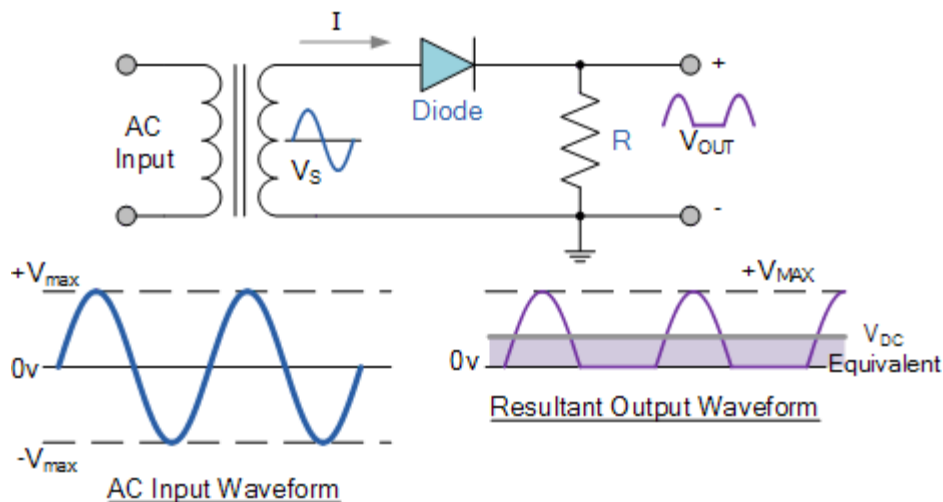
Rectifier:-

- A rectifier is an electrical device composed of one or more diodes that converts alternating current (AC) to direct current (DC). A diode is like a one-way valve that allows an electrical current to flow in only one direction. This process is called rectification.

Half wave rectifier:-

- The power diode in a half wave rectifier circuit passes just one half of each complete sine wave of the AC supply in order to convert it into a DC supply. Then this type of circuit is called a “half-wave” rectifier because it passes only half of the incoming AC power supply as shown below.

Half Wave Rectifier Circuit:-



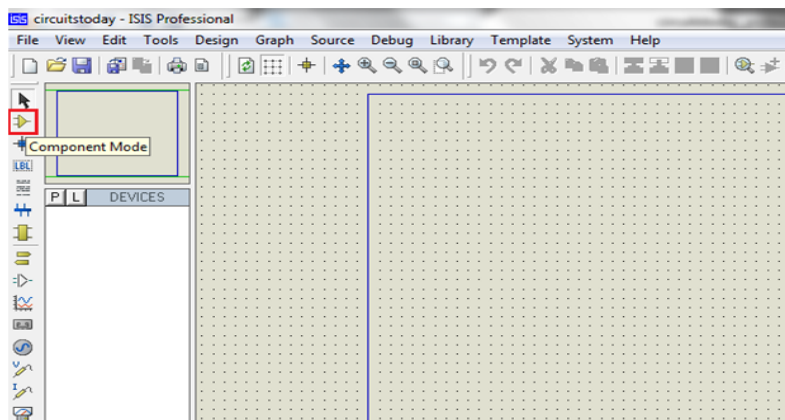
- During each “positive” half cycle of the AC sine wave, the diode is forward biased as the anode is positive with respect to the cathode resulting in current flowing through the diode.

- During each “negative” half cycle of the AC sinusoidal input waveform, the diode is reverse biased as the anode is negative with respect to the cathode. Therefore, NO current flows through the diode or circuit.

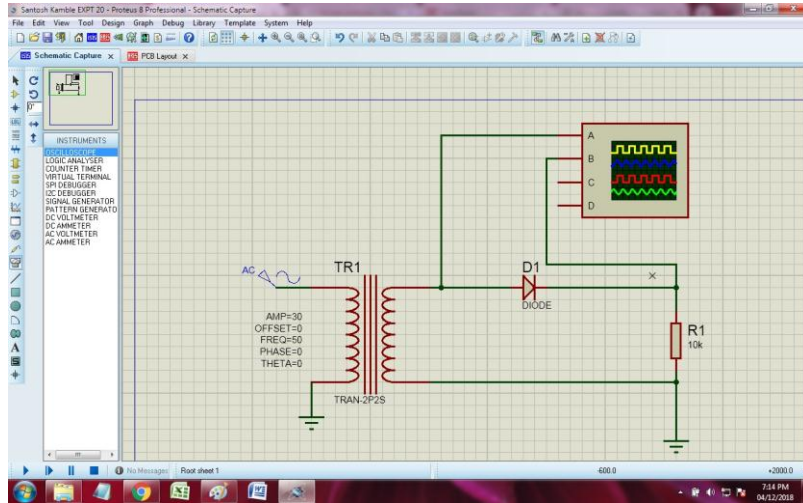
Actual Circuit diagram for simulation:-

Stepwise procedure to simulate the circuit through EDA tool Proteus:-

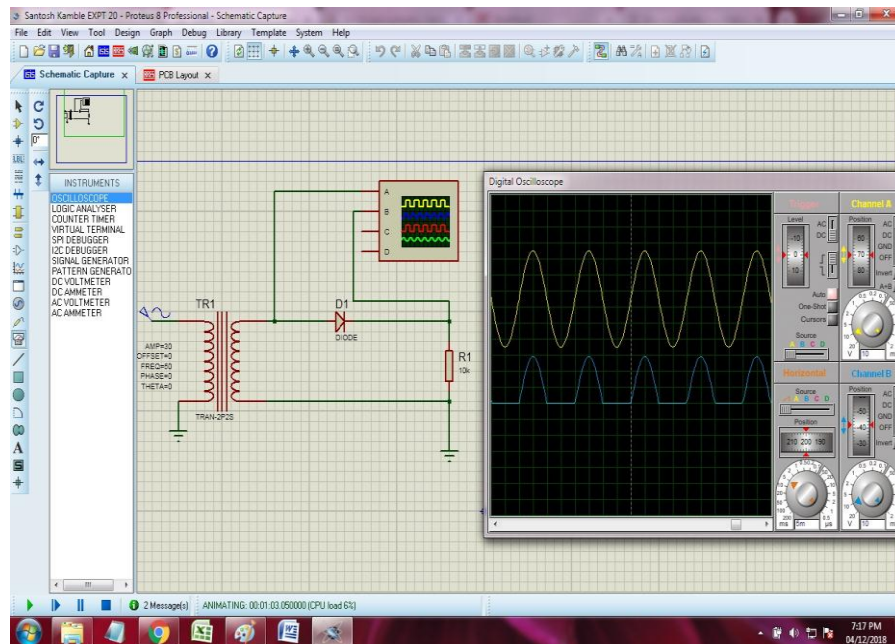
1. Open ISIS software and select New design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To Select components, Click on the component mode button.



5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.
7. Connect the as per circuit.



8. Click on the play button to run the simulation



9. Draw input and output wave forms for simulated circuit:-

Conclusion:-

Questions:-

1. Define What Is A Rectifier?
2. What Is PIV Of A Diode In A Rectifier Circuit?
3. What Is Transformer Utilization Factor?
4. What is ripple factor of half wave rectifier?

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 21

Aim: Use EDA tool to draw and simulate schematic circuit full wave rectifiers.

Apparatus: EDA software tool PROTEUS

Theory:

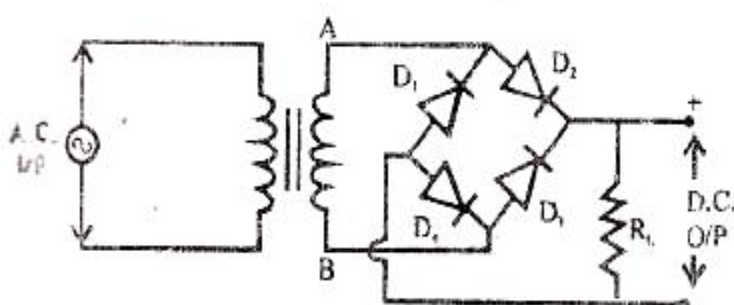
Rectifier:-

- A rectifier is an electrical device composed of one or more diodes that converts alternating current (AC) to direct current (DC). A diode is like a one-way valve that allows an electrical current to flow in only one direction. This process is called rectification.

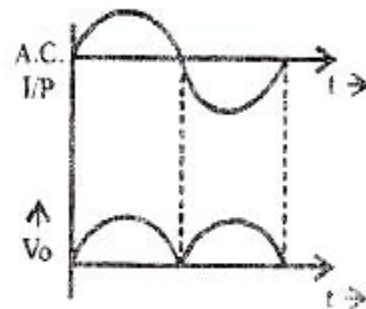
Full wave rectifier:-

- A Full wave rectifier is a circuit arrangement which makes use of both half cycles of input alternating current (AC) and converts them to direct current (DC). Thus a full wave rectifier is much more efficient (double+) than a half wave rectifier. This process of converting both half cycles of the input supply (alternating current) to direct current (DC) is termed full wave rectification.

Full wave rectifier circuit:-



a) Bridge Rectifier



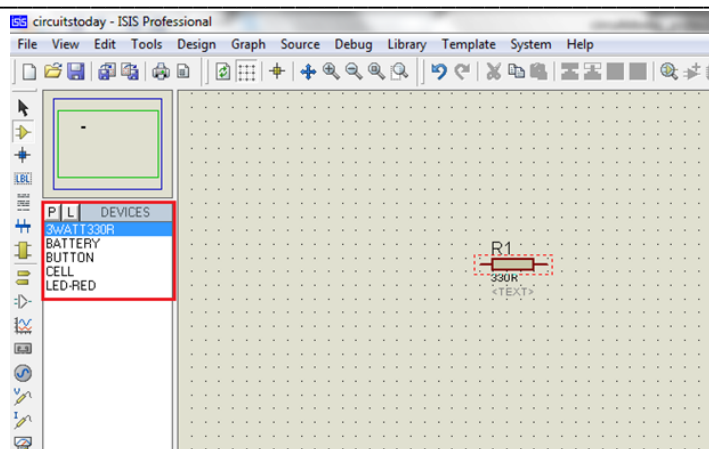
b) Waveforms

- The four diodes labeled D1 to D4 are arranged in series pairs with only two diodes conducting current during each half cycle duration. When the positive half cycle of the supply goes, D1, D2 diodes conduct in a series while diodes D3 and D4 are reverse biased and the current flows through the load. During the negative half cycle, D3 and D4 diodes conduct in a series and diodes D1 and D2 switch off.

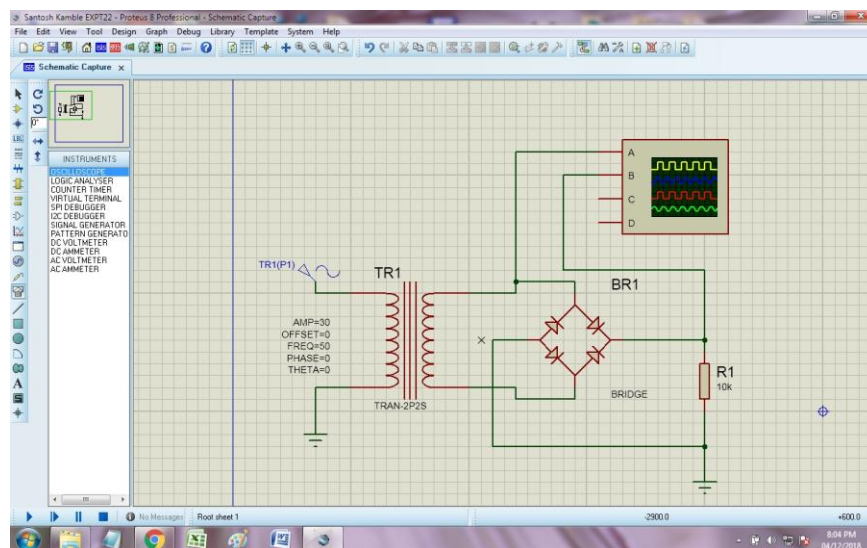
Actual Circuit diagram for simulation:-

Stepwise procedure to simulate the circuit through EDA tool Proteus:-

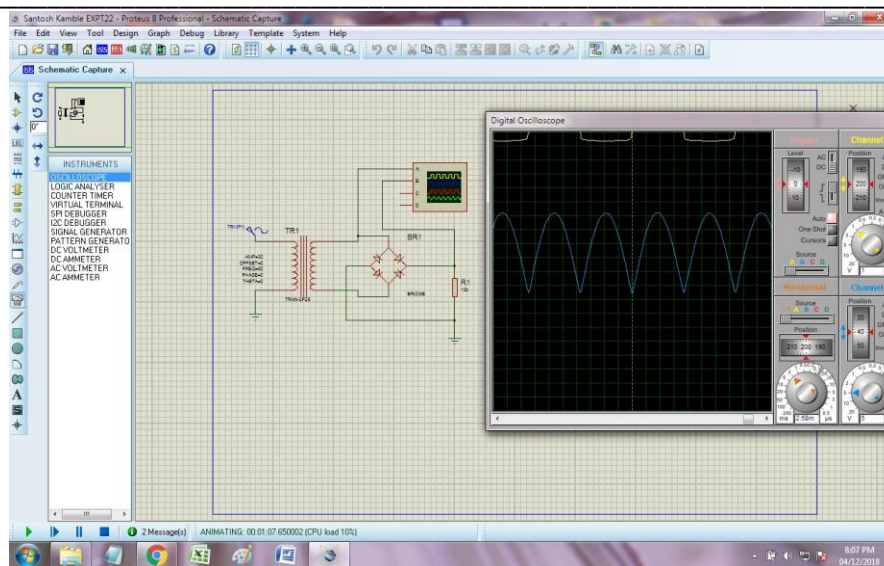
1. Open ISIS software and select New design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To Select components, Click on the component mode button.



5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.
7. Connect the as per circuit.



8. Click on the play button to run the simulation



9. Draw input and output wave forms for simulated circuit:-

Conclusion:-

Questions:-

1. Compare half wave rectifier and full wave rectifier.
2. Write advantages of full wave rectifier over half wave rectifier.
3. What do you mean by stability factor of power supply?
4. State the types of full wave rectifier.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 22

Aim: Use EDA tool to draw & simulate two stage RC coupled/transformer coupled /DC coupled Amplifier.

Apparatus: EDA software tool PROTEUS

Theory:

Need of multistage amplifier:-

- In practical applications, the output of a single stage amplifier is usually insufficient, though it is a voltage or power amplifier. Hence they are replaced by Multi-stage transistor amplifiers.
- In Multi-stage amplifiers, the output of first stage is coupled to the input of next stage using a coupling device. These coupling devices can usually be a capacitor or a transformer. This process of joining two amplifier stages using a coupling device can be called as Cascading.



Purpose of coupling device:-

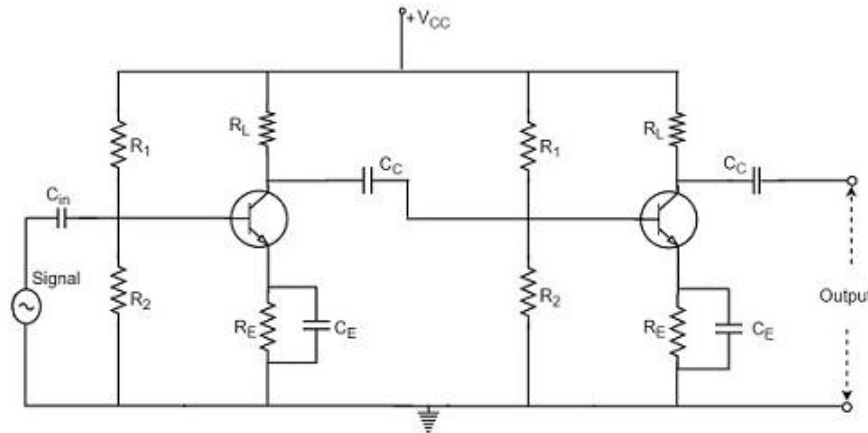
The basic purposes of a coupling device are

- To transfer the AC from the output of one stage to the input of next stage.
- To block the DC to pass from the output of one stage to the input of next stage, which means to isolate the DC conditions?

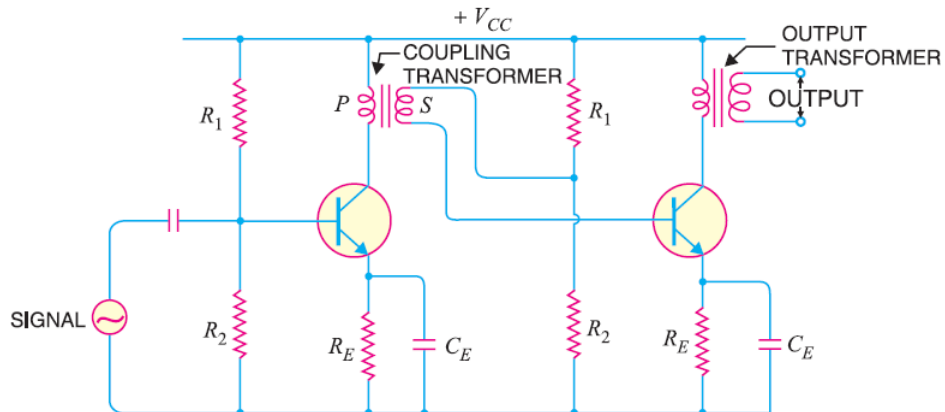
Types of multistage amplifier:-

- RC coupled Amplifier.
- Transformer coupled Amplifier.
- DC (direct) coupled Amplifier.

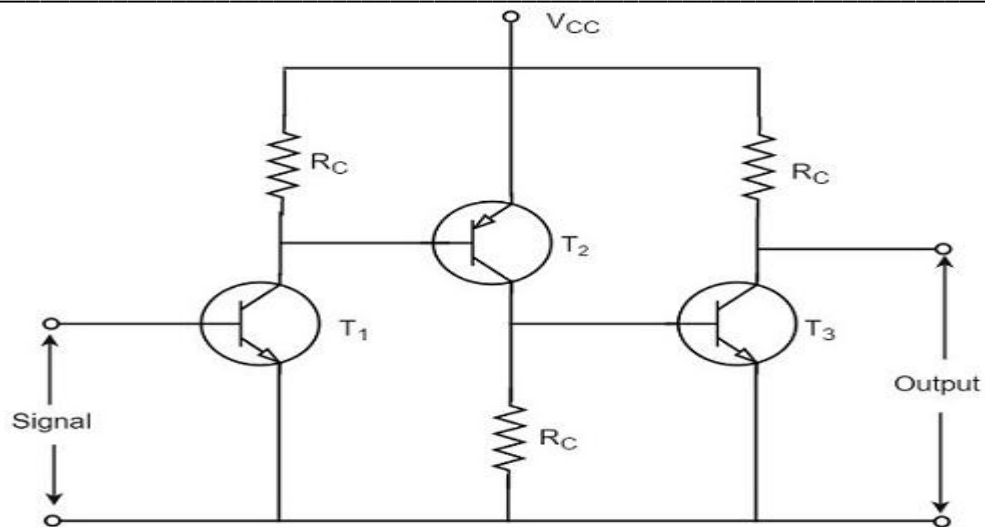
1. **Resistance-capacitance (RC) coupling:** It is most commonly used and least expensive technique which has satisfactory frequency response. In this method the signal developed across the collector resistor R_C of each stage i.e. coupled through output coupling capacitor C_c to the base of next stage. C_c isolates the DC conditions of first stage to the following stages.



2. **Transformer coupling:** In this method the signal develops across the primary winding of the transformer which is act as an load .Secondary winding transfers the ac output signal directly to the base of next stage. Such technique increases the overall gain and level impedance matching. However transformer with broad frequency response is very expensive.



3. **Direct coupled:** In this method the AC output signal is fed directly to the next stage, no reactance is used in coupling network. It is used when amplification of low frequency signal is to be done.

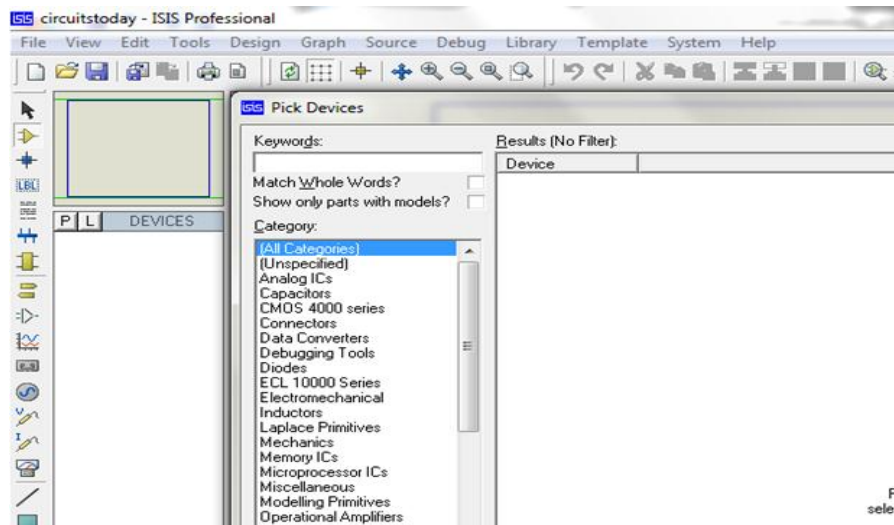


Actual Circuit diagram for simulation:-

Stepwise procedure to simulate the circuit through EDA tool Proteus:-

1. Open ISIS software and select New design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.

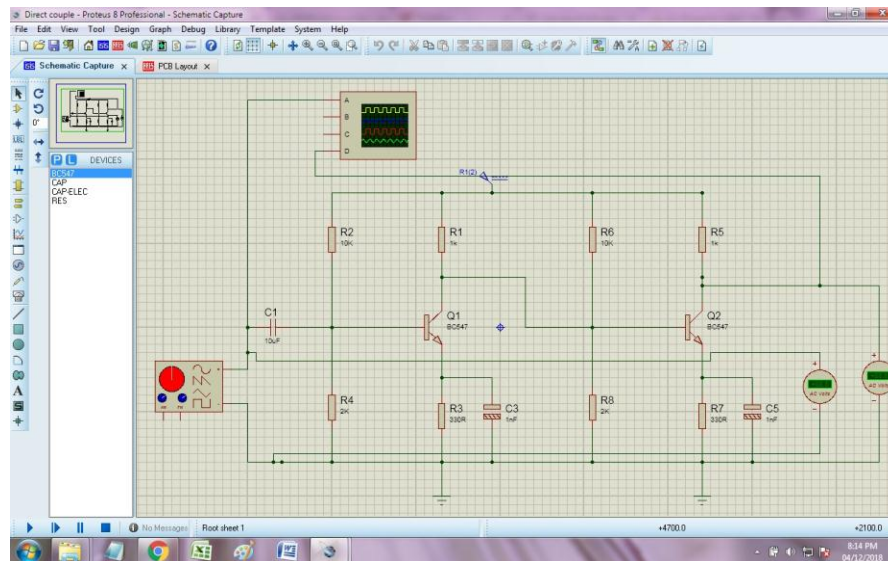
4. To Select components, Click on the component mode button.



5. Select the components from categories or type the part name in Keywords text box.

6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.

7. Connect the as per circuit.



8. Click on the play button to run the simulation

9. Draw input and output wave forms for simulated circuit:-

Conclusion:-

Questions:-

1. State the need of multistage amplifier.
2. Classify the multistage amplifier.
3. Compare RC coupled with transformer coupled amplifier.
4. Write advantages and disadvantages of direct coupled amplifier.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 23

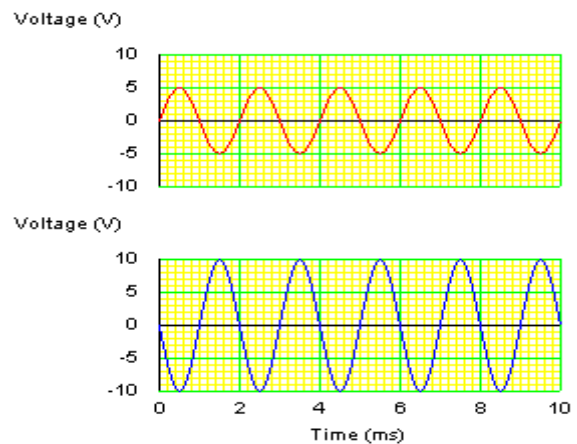
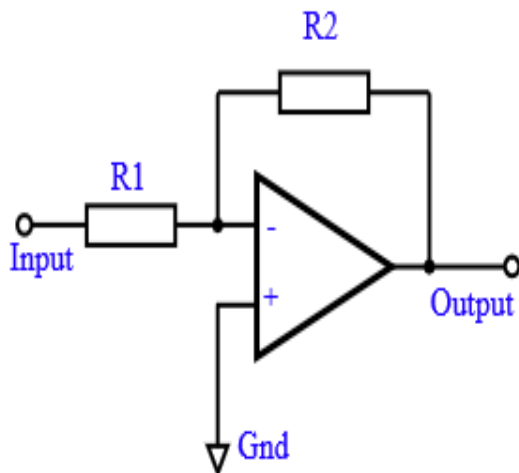
Aim: Use EDA tool to draw & simulate given circuit of inverting /non-inverting amplifier. (IC-741)

Apparatus: EDA software tool PROTEUS

Theory:

Inverting Amplifier:-

- An inverting-amplifier circuit is built by grounding the positive input of the operational amplifier and connecting resistors R1 and R2, called the feedback networks, between the inverting input and the signal source and amplifier output node, respectively.
- The basic circuit for the inverting op amp circuit is shown below. It consists of a resistor from the input terminal to the inverting amplifier input of the circuit, and another resistor connected from the output to the inverting input of the op-amp. The non-inverting input is connected to ground.

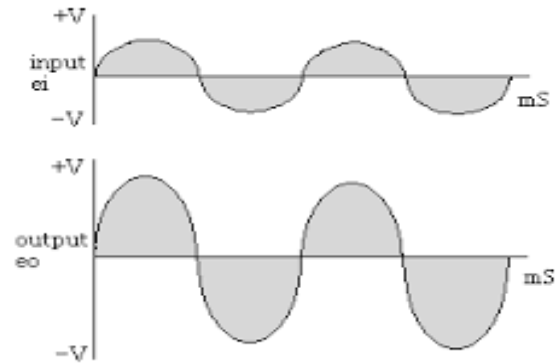
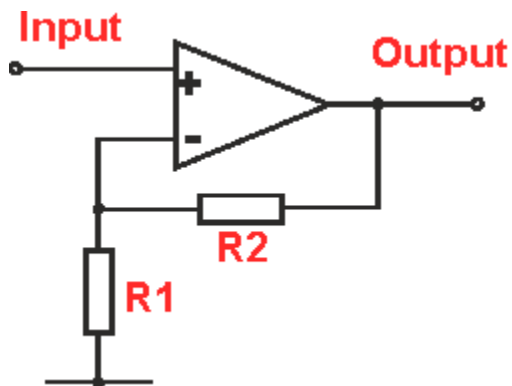


Closed-Loop Voltage Gain of an Inverting Amplifier is given as.

$$\text{Gain (Av)} = \frac{V_{\text{out}}}{V_{\text{in}}} = -\frac{R_f}{R_{\text{in}}}$$

Non-inverting Amplifier:-

- In this circuit the signal is applied to the non-inverting input of the amplifier. However the feedback is taken from the output via a resistor to the inverting input of the operational amplifier where another resistor is taken to ground. It is the value of these two resistors that govern the gain of the operational amplifier circuit.



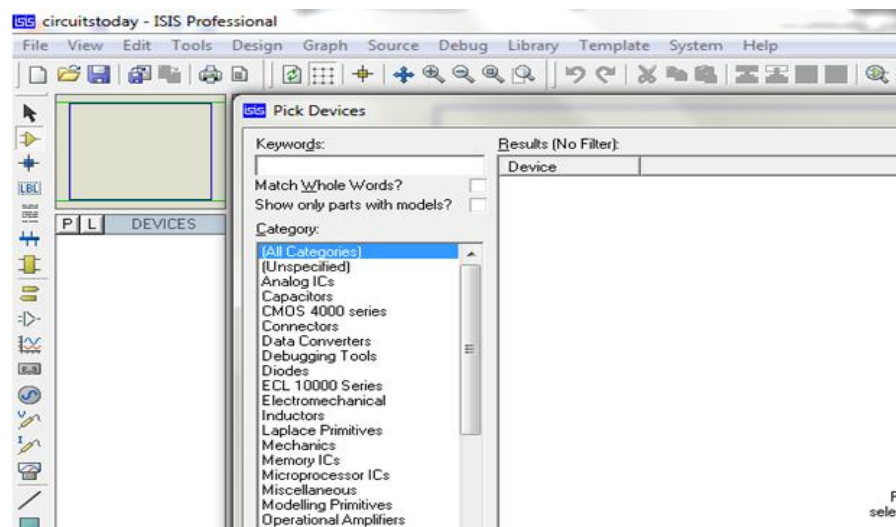
The voltage gain of the circuit A_v can be taken as,

$$\frac{V_{out}}{V_{in}} = A_v = 1 + \frac{R_2}{R_1}$$

Actual Circuit diagram for simulation:-

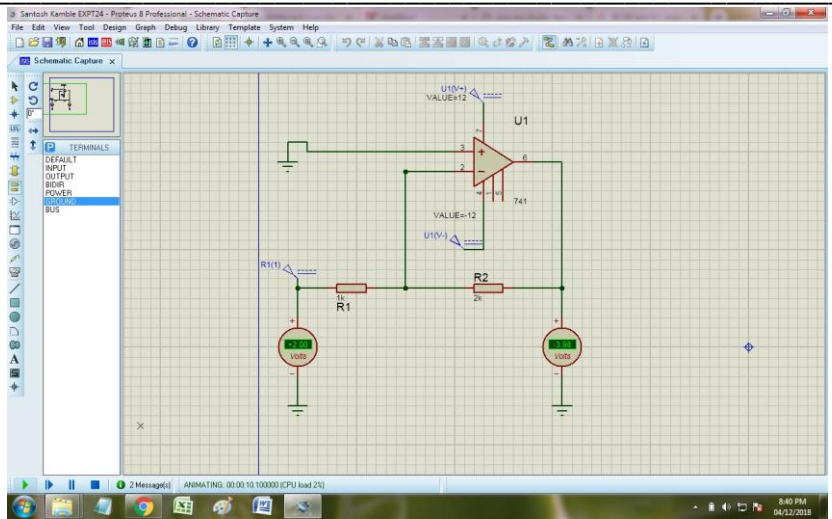
Stepwise procedure to simulate the circuit through EDA tool Proteus:-

1. Open ISIS software and select new design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To select components, Click on the component mode button.

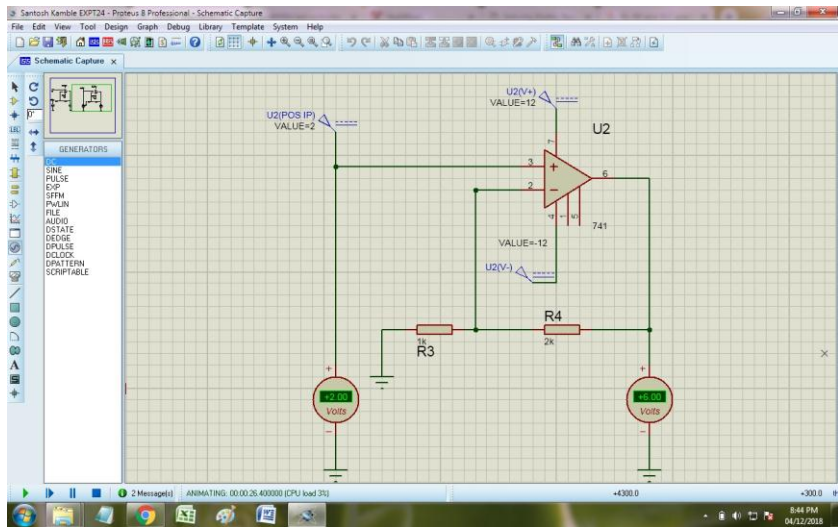


5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.
7. Connect the as per circuit.

1. Inverting amplifier



2. Non-inverting amplifier:-



8. Click on the play button to run the simulation

9. Draw input and output waveforms for simulated circuit:-

Conclusion:-

Questions:-

1. Write advantages of op-amp (741).
2. Define the terms CMRR and SVRR
3. Compare inverting and non-inverting amplifier.
4. Draw pin configuration of op-amp IC 741.
5. State voltage gain formulae for inverting and non-inverting amplifier.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 24

Aim: Use EDA tool to simulate 3 bit adder to match truth table

Apparatus: EDA software tool PROTEUS

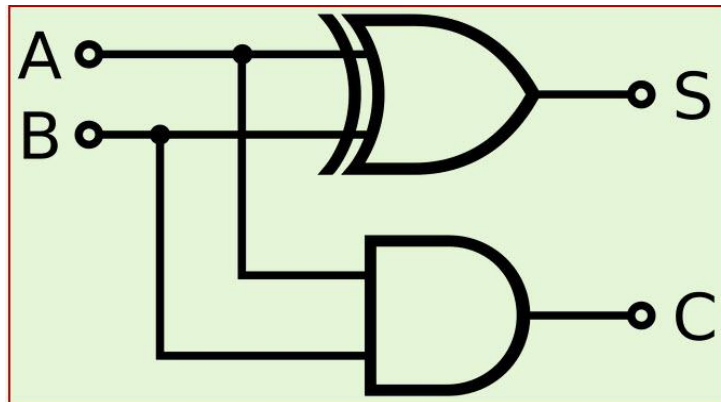
Theory:

Adder:-

- An adder is a digital logic circuit in electronics that implements addition of numbers. In many computers and other types of processors, adders are used to calculate addresses, similar operations and table indices in the ALU and also in other parts of the processors. These can be built for many numerical representations like excess-3 or binary coded decimal.
- Adders are classified into two types:
 1. Half adder
 2. Full adder.

Half adder:-

- The half adder adds two binary digits called as augend and addend and produces two outputs as sum and carry; XOR is applied to both inputs to produce sum and AND gate is applied to both inputs to produce carry.



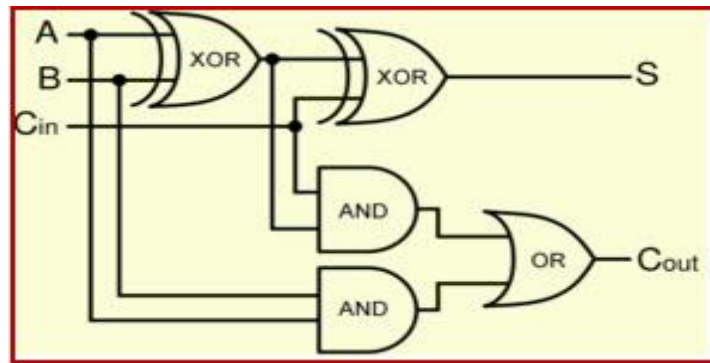
Half adder logic circuit.

INPUTS		OUTPUTS	
A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Half adder truth table

Full adder:-

- The difference between a half-adder and a full-adder is that the full-adder has three inputs and two outputs, whereas half adder has only two inputs and two outputs. The first two inputs are A and B and the third input is an input carry as C-IN. When full-adder logic is designed, you string eight of them together to create a byte-wide adder and cascade the carry bit from one adder to the next.



Full adder logic circuit.

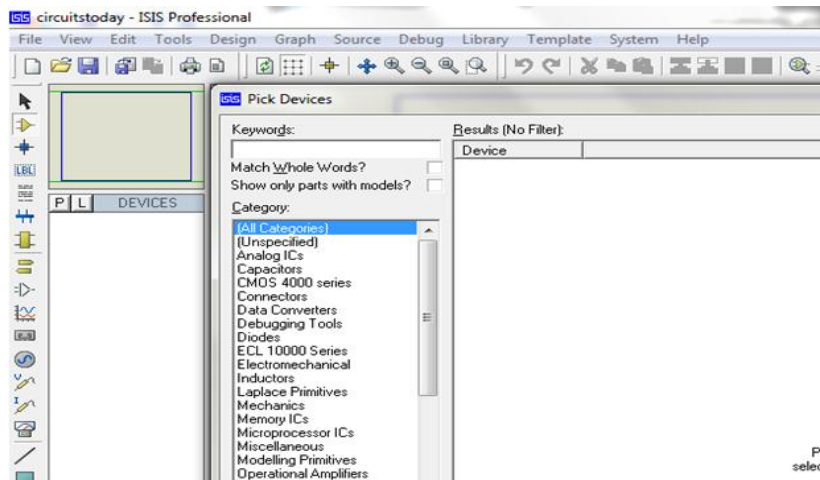
INPUTS			OUTPUT	
A	B	C-IN	C-OUT	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

Full adder truth table

Actual Circuit diagram for simulation:-

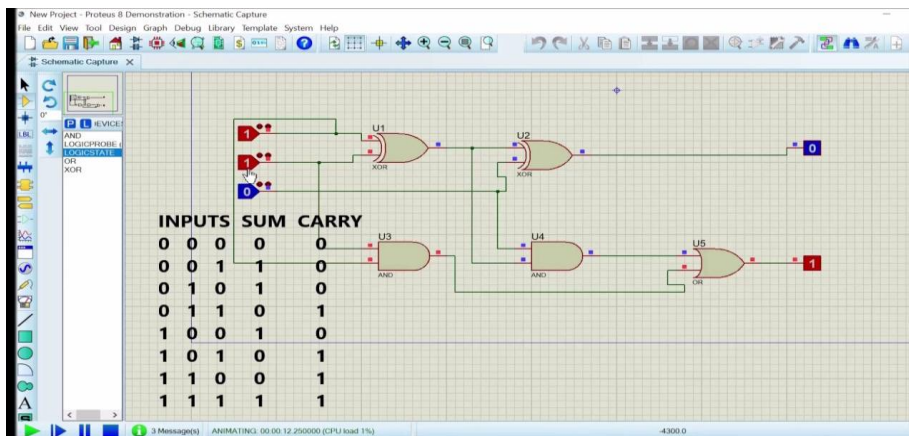
Stepwise procedure to simulate the circuit through EDA tool Proteus:-

1. Open ISIS software and select new design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To select components, Click on the component mode button.



5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.

7. Connect the as per circuit.



8. Click on the play button to run the simulation

9. Draw truth table for simulated 3 bit adder circuit.

Conclusion:-

Questions:-

1. Define adder.
2. Classify adders.
3. Draw the logic diagram and truth table for half adder.

4. Compare half adder and full adder.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	

Experiment No. 25

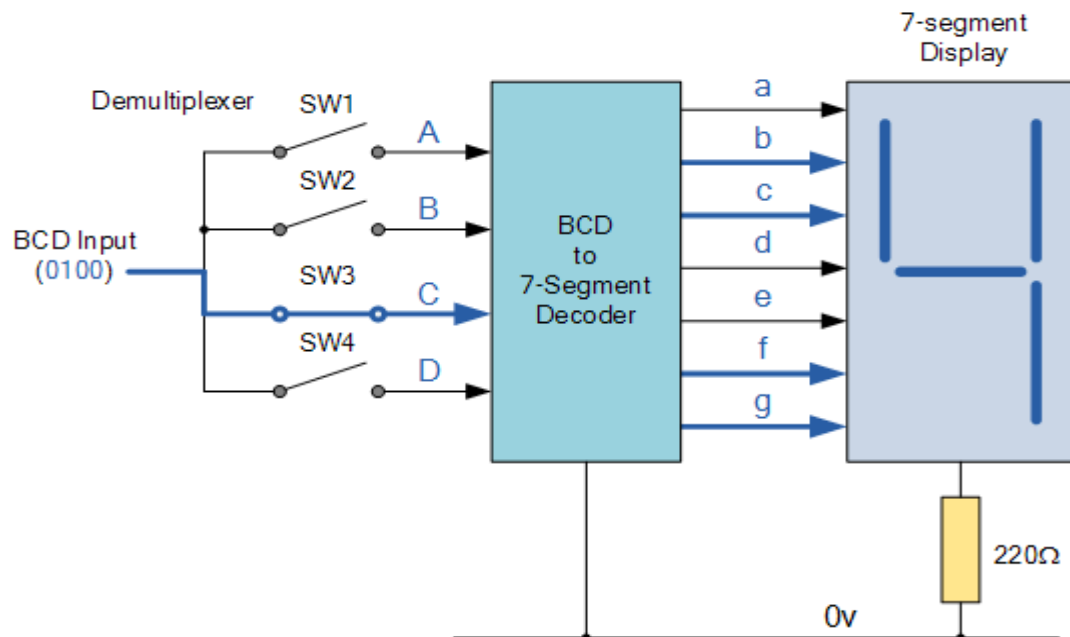
Aim: Use EDA tool to simulate BCD to 7 segment decoder.

Apparatus: EDA software tool PROTEUS

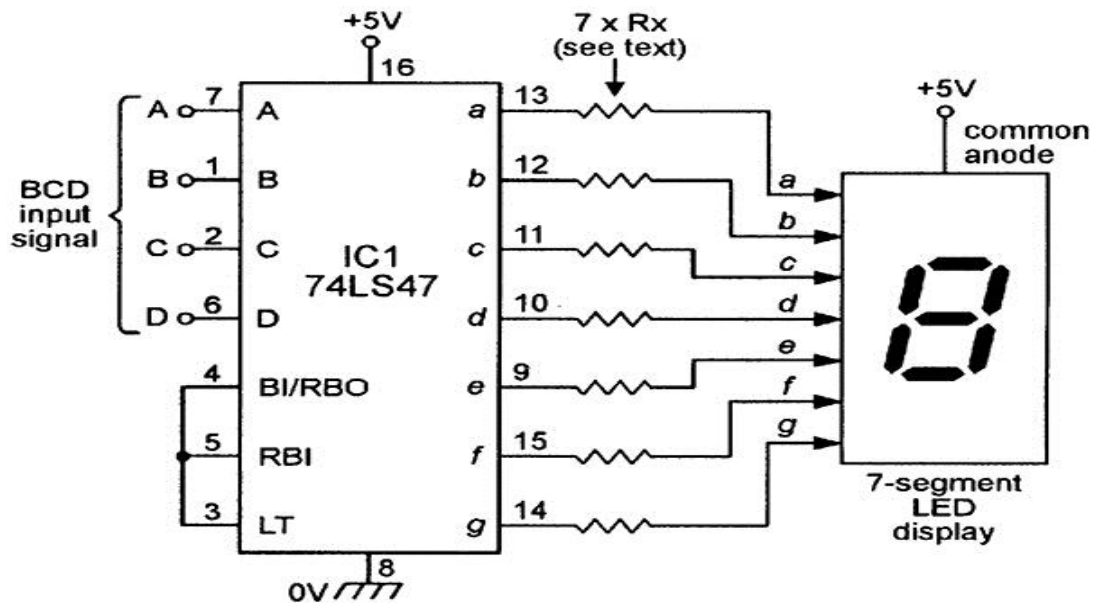
Theory:

BCD to 7-Segment Display Decoders:-

- A binary coded decimal (BCD) to 7-segment display decoder such as the TTL 74LS47 or 74LS48, have 4 BCD inputs and 7 output lines, one for each LED segment. This allows a smaller 4-bit binary number (half a byte) to be used to display all the denary numbers from 0 to 9 and by adding two displays together a full range of numbers from 00 to 99 can be displayed with just a single byte of eight data bits.



Logic diagram for BCD to 7 segment decoder:-



Decoder truth table:-

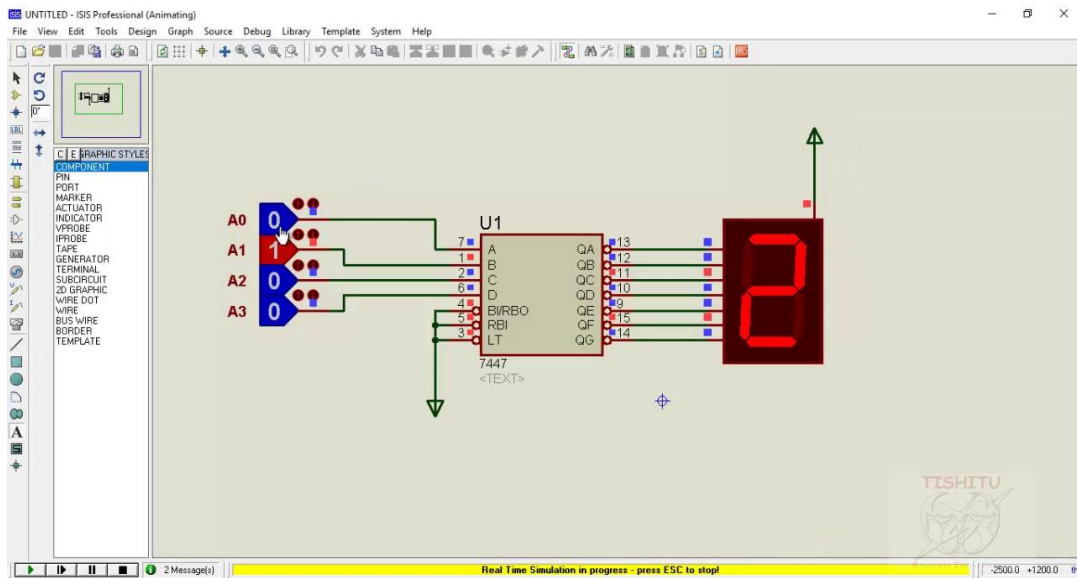
Binary Inputs	Decoder Outputs	7 Segment Display Outputs
D C B A	a b c d e f g	
0 0 0 0	1 1 1 1 1 1 0	0
0 0 0 1	0 1 1 0 0 0 0	1
0 0 1 0	1 1 0 1 1 0 1	2
0 0 1 1	1 1 1 1 0 0 1	3
0 1 0 0	0 1 1 0 0 1 1	4
0 1 0 1	1 0 1 1 0 1 1	5
0 1 1 0	1 0 1 1 1 1 1	6
0 1 1 1	1 1 1 0 0 0 0	7
1 0 0 0	1 1 1 1 1 1 1	8
1 0 0 1	1 1 1 1 0 1 1	9

Quickgrid

Actual Circuit diagram for simulation:-

Stepwise procedure to simulate the circuit through EDA tool Proteus:-

1. Open ISIS software and select new design in File menu.
2. A dialogue box appears to save the current design. However, we are creating a new design file so you can click Yes or No depending on the content of the present file. Then a Pop-Up appears asking to select the template. It is similar to selecting the paper size while printing. For now select default or according to the layout size of the circuit.
3. An untitled design sheet will be opened, save it according to your wish, it is better to create a new folder for every layout as it generates other files supporting your design. However, it is not mandatory.
4. To select components, Click on the component mode button.
5. Select the components from categories or type the part name in Keywords text box.
6. The selected components will appear in the devices list. Select the component and place it in the design sheet by left-click.
7. Connect the as per circuit.



8. Click on the play button to run the simulation.

9. Draw truth table for simulated BCD to 7segment decoder.

Conclusion:-

Questions:-

1. List applications of BCD to 7 Segment decoder.
2. What is difference between common anode and common cathode 7 segment LED?
3. List different IC's for BCD to Seven segment decoder.

[Space for Answers]

Marks Obtained			Dated signature of teacher
Process Related(15)	Product Related(10)	Total (25)	