ELECTRONICS MECHANIC

NSQF LEVEL - 5

1st Year (Volume I of II)

TRADE PRACTICAL

SECTOR: ELECTRONICS & HARDWARE

Sector : Electronics & Hardware

Duration : 2 - Years

Trade : Electronics Mechanic - 1st Year (Volume I of II) - Trade Practical - NSQF level 5

Developed & Published by

FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Mentor Councils comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, an autonomous body under the Directorate General of Training (DGT), Ministry of Skill Development & Entrepreneurship is entrusted with developing producing and disseminating Instructional Media Packages (IMPs) required for ITIs and other related institutions.

The institute has now come up with instructional material to suit the revised curriculum for **Electronics Mechanic - Trade Practical - 1st Year (Volume I of II) in Electronics & Hardware Sector .** The NSQF Level - 5 Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 5 trainees will also get the opportunities to promote life long learning and skill development.   I have no doubt that with NSQF Level - 5 the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

RAJESH AGGARWAL
Director General / Addl. Secretary,
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New Delhi - 110 001

PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of the Federal Republic of Germany. The prime objective of this institute is to develop and provide instructional materials for various trades as per the prescribed syllabi under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

In order to perform the skills in a productive manner instructional videos are embedded in QR code of the exercise in this instructional material so as to integrate the skill learning with the procedural practical steps given in the exercise. The instructional videos will improve the quality of standard on practical training and will motivate the trainees to focus and perform the skill seamlessly.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

R. P. DHINGRA
Executive Director
NIMI, Chennai.

ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisations to bring out this Instructional Material **(Trade Practical)** for the trade of **Electronics Mechanic - 1st Year (Volume I of II)- NSQF Level 5** under Electronics and Hardware sector.

INTRODUCTION

TRADE PRACTICAL

The trade practical manual is intented to be used in workshop . It consists of a series of practical exercies to be completed by the trainees during the 1st Year course of the Electronic Mechanic Trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered.

The manual is divided into Ten modules. The distribution of time for the practical in the Ten modules are given below.

Module 1	Basic Workshop Practice	75 Hrs
Module 2	Basics of AC and Electrical Cables	45 Hrs
Module 3	Single Range Meters	30 Hrs
Module 4	Cells & Batteries	25 Hrs
Module 5	AC & DC Measuring Instruments	50 Hrs
Module 6	Soldering/Desoldering and various switches	25 Hrs
Module 7	Active and Passive Components	75 Hrs
Module 8	Power Supply Circuits	50 Hrs
Module 9	Computer Hardware, OS,MS Office and Networking	125 Hrs
Module 10	IC Regulators	25 Hrs
	Project Work	50 Hrs
	Total	575 Hrs

The skill training in the computer lab is planned through a series of practical exercises centred around some practical project. However, there are few instance where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there if a scope for further improvement. NIMI, looks forward to the suggestions from the experienced training faculty for improving the manual.

TRADE THEORY

The manual of trade theory consists of theoretical information for the 1st Year course of the Electronic Mechanic Trade. The contents are sequenced according to the practical exercise contained in the manual on Trade practical. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This co-relation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The Trade Theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indicating about the corresponding practical exercise are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not the purpose of self learning and should be considered as supplementary to class room instruction.

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LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.**

- **Select and perform electrical/electronic measurement of single range meters and calibrate the instrument.**

- **Test & service different batteries used in electronic applications and record the data to estimate repair cost.**

- **Plan and execute soldering & desoldering of various electrical components like switches, PCB & Transformers for electronic circuits.**

- **Test various electronic components using proper measuring instruments and compare the data using standard parameters.**

- **Assemble simple electronic power supply circuit and test for functioning.**

- **Install, configure, interconnect given computer system (s) and demonstrate & utilize application packages for different applications.**

SYLLABUS

Week No.	Ref. Learning Outcome	Professional Skills (Trade Practical) with Indicative hours	Professional Knowledge (Trade Theory)
1	Apply safe working practices	**Trade and Orientation** 1 Visit to various sections of the institute and identify location of various installations. (5 hrs) 2 Identify safety signs for danger, warning, caution & personal safety message. (3 hrs.) 3 Use of personal protective equipment (PPE). (5 hrs) 4 Practice elementary first aid. (5 hrs) 5 Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs) 6 Use of Fire extinguishers. (5 hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.
2-3	Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc observing suitable care & safety	**Hand tools and their uses** 7 Identify the different hand tools. (5 hrs) 8 Selection of proper tools for operation and precautions in operation. (7 hrs) 9 Care & maintenance of trade tools. (8 hrs) 10 Practice safety precautions while working in fitting jobs. (10 hrs) 11 Workshop practice on filing and hacksawing. (5 hrs) 12 Practice simple sheet metal works, fitting and drilling. (5 hrs) 13 Make an open box from metal sheet. (10 hrs)	Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.
4-5 .	Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	**Basics of AC and Electrical Cables** 14 Identify the Phase, Neutral and Earth on power socket, use a testers to monitor AC power. (6 hrs) 15 Construct a test lamp and use it to check mains healthiness. (7 hrs) 16 Measure the voltage between phase and ground and rectify earthing. (5 hrs) 17 Identify and test different AC mains cables. (7 hrs) 18 Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (7 hrs) 19 Measure the gauge of the wire using SWG and outside micrometer. (5 hrs) 20 Refer table and find current carrying capacity of wires. (3 hrs) 21 Crimp the lugs to wire end. (5 hrs) 22 Measure AC and DC voltages using multi meter. (5 hrs)	Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.

6	Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	23 Identify the type of meters by dial and scale marking/ symbols. (3 Hrs) 24 Demonstrate various analog measuring Instruments. (3 Hrs) 25 Find the minimum and maximum measurable range of the meter. (3 Hrs) 26 Carryout mechanical zero setting of a meter. (5 Hrs) 27 Check the continuity of wires, meter probes and fuse etc. (5 Hrs) 28 Measure voltage and current using clamp meter. (6 Hrs)	**Single range meters** Introduction to electrical and electronic measuring instruments. Basic principle and parts of simple meters. Specifications, symbols used in dial and their meaning.
7	Test & service different batteries used in electronic applications and record the data to estimate repair cost.	**Cells & Batteries** 29 Identify the +ve and -ve terminals of the battery. (2 hrs) 30 Identify the rated output voltage and Ah capacity of given battery. (1 hrs) 31 Measure the voltages of the given cells/ battery using analog/ digital multimeter. (3 hrs) 32 Charge and discharge the battery through load resistor. (5 hrs) 33 Maintain the secondary cells. (5 hrs) 34 Measure the specific gravity of the electrolyte using hydrometer. 3 hrs) 35 Test a battery and verify whether the battery is ready for use of needs recharging. (6 hrs)	**Cells & Batteries** Construction, types of primary and secondary cells. Materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/ battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections.
8-9	Test various electronic compo-nents using proper measuring instruments and compare the data using standard parameter.	**AC & DC measurements** 36 Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R) (8 hrs.) 37 Identify the different types of meter for measuring AC & DC parameters (8 hrs.) 38 Identify the different controls on the CRO front panel and observe the function of each control (12hrs.) 39 Measure DC voltage, AC voltage, time period using CRO sine wave parameters (10hrs.) 40 Identify the different controls on the function generator front panel and observe the function of each controls (12 hrs.)	Introduction to electrical measuring instruments. Importance and classification of meters. Forces necessary to work a meter. MC and MI meters. Range extension, need of calibration. Characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter
10	Plan and execute soldering & desoldering of various electrical compo - nents like Switches, PCB & Transformers for electronic circuits.	**Soldering/ De-soldering and Various Switches** 41 Practice soldering on different electronic components, small transformer and lugs. (5 hrs) 42 Practice soldering on IC bases and PCBs. (5 hrs) 43 Practice de-soldering using pump and wick (2 hrs) 44 Join the broken PCB track and test (3 hrs)	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches, their specification and usage.

		45 Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries (5 hrs)	
		46 Make a panel board using different types of switches for a given application (5 hrs)	
11-13	Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**Active and Passive Components** 47 Identify the different types of active electronic components. (3 hrs). 48 Measure the resistor value by colour code and verify the same by measuring with multimeter (3 hrs) 49 Identify resistors by their appearance and check physical defects. (2 hrs) 50 Identify the power rating of carbon resistors by their size. (3 hrs) 51 Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (9 hrs) 52 Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law (5 Hrs) 53 Verify laws of series and parallel circuits with voltage source in different combinations. (5 hrs) 54 Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter (8 hrs) 55 Identify different inductors and measure the values using LCR meter (5 hrs) 56 Identify the different capacitors and measure capacitance of various capacitors using LCR meter (5 hrs) 57 Identify and test the circuit breaker and other protecting devices. (5 hrs) 58 Dismantle and identify the different parts of a relay. (5 hrs) 59 Connect a timer relay in a circuit and test for its working. (3 hrs) 60 Connect a contactor in a circuit and test for its working (2 hrs) 61 Construct and test RC time constant circuit (4 hrs) 62 Construct a RC differentiator circuit and convert triangular wave into square wave (5 hrs.) 63 Construct and test series and parallel resonance circuit (3 hrs)	Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, color coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications and energy storage concept. Self and Mutual induction. Behaviour of inductor at low and high frequencies. Series and parallel combination, Q factor. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behaviour with AC and DC. Concept of Time constant of a RC circuit. Concept of Resonance and its application in RC, RL & RLC series and parallel circuit. Properties of magnets and their materials, preparation of artificial magnets, significance of electro magnetism, types of cores. Relays, types, construction and specifications etc.
14-15	Assemble simple electronic power supply circuit and test for functioning.	**Power Supply Circuits** 64 Identify different types of diodes, diode modules and their specifications. (5 hrs) 65 Test the given diode using multi meter and determine forward to reverse resistance ratio. (5 hrs)	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications.

		66 Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (8 hrs)	Forward current and Reverse voltage.
			Packing styles of diodes.
		67 Identify different types of transformers and test. (3 hrs)	Different diodes, Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple.
		68 Identify the primary and secondary transformer windings and test the polarity (2 hrs)	Working principles of Zener diode, varactor diode, their specifications and applications.
		69 Construct and test a half wave, full wave and Bridge rectifier circuit. (10 hrs)	Working principle of a Transformer, construction, Specifications and types of cores used.
		70 Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. (5 hrs)	Step-up, Step down and isolation transformers with applications.
		71 Identify and test Zener diode. (2 hrs)	Losses in Transformers.
		72 Construct and test Zener based voltage regulator circuit. (5 hrs)	Phase angle, phase relations, active and reactive power, power factor and its importance.
		73 Calculate the percentage regulation of regulated power supply. (5 hrs)	
16-20	Install, configure, interconnect given computer system (s) and demonstrate & utilize application packages for different application.	**Computer Hardware, OS, MS office and Networking**	Basic blocks of a computer, Components of desktop and motherboard.
		74 Identify various indicators, cables, connectors and ports on the computer cabinet. (5 hrs)	Hardware and software, I/O devices, and their working.
		75 Demonstrate various parts of the system unit and motherboard components. (5 hrs)	Different types of printers, HDD, DVD.
		76 Identify various computer peripherals and connect it to the system. (5 hrs)	Various ports in the computer. Windows OS
		77 Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (5 hrs)	MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications.
		78 Replace the CMOS battery and extend a memory module. (5 hrs)	
		79 Test and Replace the SMPS (5 hrs)	
		80 Replace the given DVD and HDD on the system (5 hrs)	
		81 Dismantle and assemble the desktop computer system. (10 hrs)	
		82 Boot the system from Different options (5 hrs)	Concept of word processing,: MS word – Menu bar, standard tool bar, editing, formatting, printing of document etc.
		83 Install OS in a desktop computer. (5 hrs)	
		84 Install a Printer driver software and test for print outs (5 hrs)	Excel – Worksheet basics, data entry and formulae. Moving data in worksheet using tool bars and menu bars, Formatting and calculations, printing worksheet, creating multiple work sheets, creating charts.
		85 Install antivirus software, scan the system and explore the options in the antivirus software. (5 hrs)	
		86 Install MS office software (5 hrs)	
		87 Create folder and files, draw pictures using paint. (5 hrs)	Introduction to power point Basics of preparing slides, different design aspects of slides, animation with slides etc.
		88 Explore different menu/ tool/ format/ status bars of MS word and practice the options. (8 hrs)	
		89 Explore different menu/ tool/ format/ status bars of MS excel and practice the options. (7 hrs)	Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.
		90 Prepare power point presentation on any three known topics with various design, animation and visual effects. (5 hrs)	

		91 Convert the given PDF File into Word file using suitable software. (5 hrs) 92 Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (5 hrs) 93 Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (5 hrs) 94 Prepare terminations, make UTP and STP cable connectors and test. (5 hrs) 95 Connect network connectivity hardware and check for its functioning. (5 hrs) 96 Configure a wireless Wi-Fi network (5 hrs)	**Computer Networking:-** Network features - Network medias Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.
21	Assemble simple electronic power supply circuit and test for functioning.	**IC Regulators** 97 Construct and test a +12V fixed voltage regulator. (5 hrs) 98 Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series) (5 hrs) 99 Identify different heat sinks for IC based regulators. (2 hrs) 100 Observe the output voltage of different IC 723 metal/ plastic type and IC 78S40 regulators by varying the input voltage with fixed load (8 hrs) 101 Construct and test a 1.2V – 30V variable output regulated power supply using IC LM317T. (5 hrs)	Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator, (Transistorized & IC based). Voltage regulation, error correction and amplification etc.
22-23	**Project work / Industrial visit** **Broad areas:** 1 Full wave Voltage rectifier with indicator. 2 Transformer less 12 V dual power supply 3 Versatile regulated power supply 4 AC/DC voltage tester. 5 Modular rectifiers. 6 Half wave dual power supply with zener diode.		
24-25	Revision		

Visit various sections of the ITI and identify the location of various installations

Objective: At the end of this exercise you shall be able to
• **list the trades available at the ITI**
• **identify the staff and their designations**
• **draw the layout of the Electronics Mechanic laboratory**
• **identify the location of power room and switch controls.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool kit - 1 Set • Steel rule, 300 mm - 1 No	• Pencil HB - 1 No • Eraser - 1 No • Drawing sheet - A 4 size - 3 Nos

PROCEDURE:

TASK 1: **Visiting various sections of ITI and identification of Trades.**

> **Instructor has to lead the trainees to visit various sections of the ITI.**

1 Follow the Instructor, identify each section, name of the staff member, designation and record them in Table - 1

Table - 1

SI No	Name of the section /Trade	Staff member	Designation	Phone number
1				
2				
3				

2 Collect the telephone numbers of ITI office, nearest hospital, police station, fire station and record them in Table - 2

Table - 2

SI No.	Place	Phone No	Remarks
1	ITI office		
2	Hospital		
3	Police station		
4	Fire station		

> **The Instructor may add column for any important aspect if required in Table - 2**

3 Get the work checked by the Instructor.

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TASK 2: **Drawing the layout of E.M. laboratory / Section and identification of control switches**

1 Draw the plan of EM laboratory / section to a suitable scale in drawing sheet.

2 Identify the location of AC mains power control / back - up power, distribution board, MCB and lighting switch controls.

3 Mark the locations of the above points on the plan drawing / diagram.

> **Instructor may help them to operate the important switches in case of any emergency situation.**

4 Get the work checked by the Instructor.

— — — — — — — —

1

Identify safety signs for danger, warning, caution & personal safety message

Objective: At the end of this exercise you shall be able to
• **identify different types of safety signs.**
• **prepare safety sign boards.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit	- 1 Set
• Scissors	- 1 No

Aids: Wall chart showing all types of safety signs as per the trade syllabus.

Materials/Components

• Pencil - HB	- 1 No
• Eraser	- 1 No
• Drawing Sheet - A 4 size	- 5 Nos
• Colour Sketch Pen	- 1 Set
• Cardboard	- 1 No
• Gum	- 1 No
• Twine Thread	- 1 Roll
• Geometry Box	- 1 No
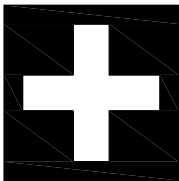
The instructor has to arrange for various types of safety signs with label number for each one.
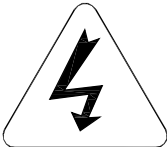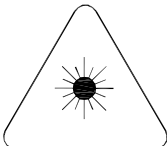
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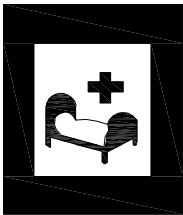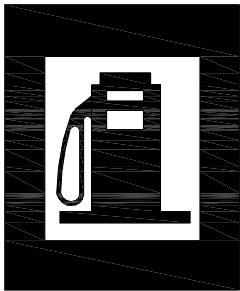
TASK 1: **Identification of different safety signs**

Identify the labelled safety sign, record type of safety sign and the meaning in Table 1.

Table 1

Label No.	Sign	Type	Meaning
1			
2			
3			
4			

2

Label No.	Sign	Type	Meaning
5			
6			
7			
8			
9			
10			
11			
12			
13			

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Label No.	Sign	Type	Meaning
14			
15			
16			
17			
18			

2   Get the work checked by the Instructor.

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TASK 2: **Preparation of safety sign boards**

1   Draw the free hand sketch of warning sign on A4 sheet using geometry box.

2   Use sketch pens and apply appropriate colours, finalise the diagram.

3   Cut along the outside line of the prepared diagram using scissors.

4   Keep the safety sign diagram on the card board, mark along the outside line using pencil and cut the excess portion.

5   Paste the prepared safety sign diagram on the card board using gum and allow it to dry up.

6   Make a small hole, insert the thread and tie it to hang the prepared safety sign board as shown in Fig 1.

Fig 19

WARNING
FALLING OBJECTS

EMN1102J1

7   Get the work checked by the Instructor.

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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.1.02

Use of Personal Protective Equipment (PPE)

Objective: At the end of this exercise you shall be able to
• **state the use of different PPEs**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Pencil	- 1 No
Aids:		• Eraser	- 1 No
Chart showing all types of PPE items	- 1 No	• Drawing sheet	- 1 No
		• Colour Sketch pen	- 1 Set

> **The Instructor has to arrange a minimum of Five PPE items and label them before issuing to trainees.**

PROCEDURE

TASK 1: **Stating the use of different PPEs**

1 Identify the labelled PPE item and record the details of each Personal protective Equipment in column- 3 to 5 about name type of protection and uses in Table - 1.

Table - 1

Label No.	Sign	Name	Type of Protection	Uses
1				
2				
3				
4				
5				
6				

2 Get the work checked by the Instructor. __ __ __ __ __ __ __ __

5

Practice elementary first aid

Objective: At the end of this exercise you shall be able to
• **study and practice on first aid Artificial respiration.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Rubber mat. - 1 No • Wall chart on Artificial respiration practice - as reqd • Audio Visual Aids: video film on Artificial respiration - as reqd	• Dry wooden stick - 1 No

PROCEDURE

TASK 1: **Providing First-aid to the Victim**

1   Put the main switch to OFF so as to release the victim from live line contact. Increase of difficulty to reach the main switch release the victim by means of a wooden stick / rubber item etc. while keeping yourself isolated from the "Earth" contact.

2   If the victim is unconscious or blisters (Burns) have developed on his/her body then call a doctor through telephone or through some one else but do not leave the victim.

3   Start the following first-aid procedure till the doctor is available:

i   Loosen or remove victim's shoes, cloths etc. But take care that the blisters (Burns) do not break.

ii   Cover victim's body by using a blanket so as to keep him/her warm.

iii If the victim's breathing appears to be suppressed then remove the crowd from his / her surroundings. If the victim is in a room then open up all doors and windows so as to enable him / her to breath in fresh air.

4   Remove artificial teeth, tobacco etc. from the victim's mouth and start artificial respiration procedure (suitable) for restoring normal breathing.

TASK 2: **Providing Artificial Respiration**

a   HOLGEN-NELSON'S method

> • **Nelson's arm-lift back pressure method must not be used in case of suspected injuries to the chest wall or abdomen of the victim.**
>
> • **Be brisk in carrying out this method but avoid violent operations which may cause injury to the internal parts of the victim.**

1   As shown in the Fig 1 place the victim face down with his arms folded, palms one over the other and head resting on his cheek over the palms. Kneel on one or both knees at the victim's hand. Place your hands on the victim's back beyond the line of the armpits. Spread your fingers outwards and downwards with the thumbs just touching each other.

2   As shown in the Fig 2 gently rock forward the arms keeping them straight until they are nearly vertical, and thus steadily pressing the victim's back as shown to force the air out of the victim's lungs.

3   Synchronising the above movement rock backwards sliding your hands downwards along the victim's arms. Grasp his arm just above the elbows as shown in Fig 3.

4   Now rock backwards. As you rock backwards, gently raise and pull the victim's arms towards you as shown in figure until you feel tension in his shoulders. Remain in this position for a few seconds. To complete the cycle, lower the victim's arm and move your hands up to the initial position.

5   Repeat the cycles a few more times by following steps 3 to 6.

Fig 1

HEAD RESTING ON CHEEK OVER THE PALMS

HANDS ON THE BACK BEYOND LINE OF ARM PIT

ARMS FOLDED

EMN1104H1

6

Fig 2

ARMS STRAIGHT AND NEARLY VERTICAL

BACK PRESSED

EMN1104H2

Fig 3

HANDS DOWNWARDS

GRASP THE UPPER ARMS JUST ABOVE THE ELBOWS.

EMN1104H3

Fig 4

ARMS PULLED
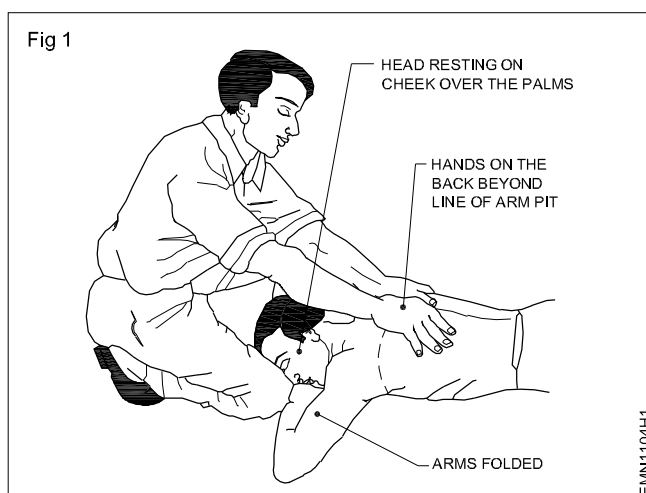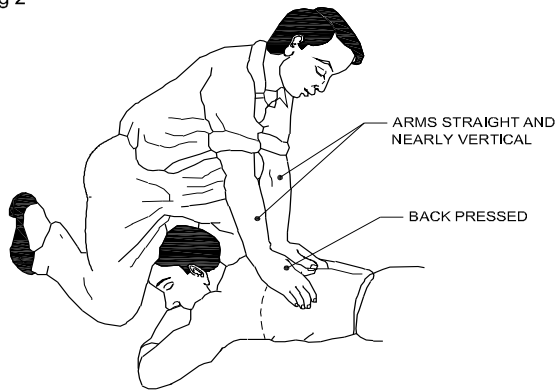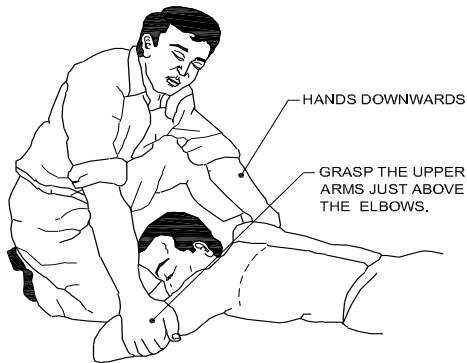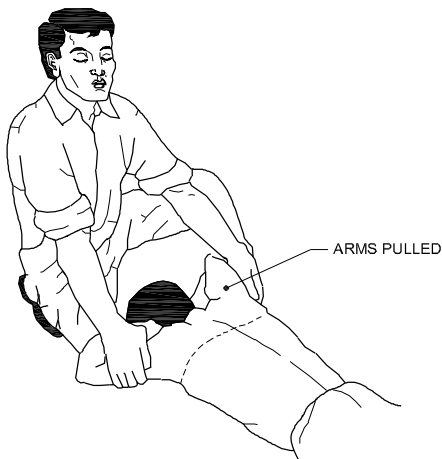
EMN1104H4

b **SCHAFER'S method:**

> • **Do not use this method of artificial respiration in case the victim has injuries on his chest or abdomen.**
>
> • **Be brisk in carrying out this method but avoid violent operations which may cause injury to the internal parts of the victim.**

1 Lay the victim on his abdomen. Extend one arm directly forward, and the other arm bent at the elbow as shown in Fig 5. Keep the face turned sidewise and resting on the hand or forearm as shown in Fig 5.

2 Kneel astride the victim as shown in Fig 6 such that his thighs are in between your knees. Position your fingers and thumb as shown in figure.

3 With the arms held straight, swing forward slowly so that the weight of your body is gradually applied on the lower ribs of the victim as shown in figure. This weight forces the air out of the victim's lungs.

4 Now swing backward immediately removing all pressure on the lower ribs. This allows the lungs to get filled with air.

5 After 2 to 3 seconds, swing forward again and repeat the cycle (from step 4 to 5) twelve to thirteen times in a minute.

Fig 5

LITTLE FINGER ALONG LOWEST RIB

MOUTH AND NOSE OPEN

THUMB ALONG FINGERS

EMN1104H5

Fig 6

ELBOWS STRAIGHT THIGHS AND ARMS PERPENDICULAR TO THE GROUND

WEIGHT OF THE BODY ON HEAL OF THE HAND
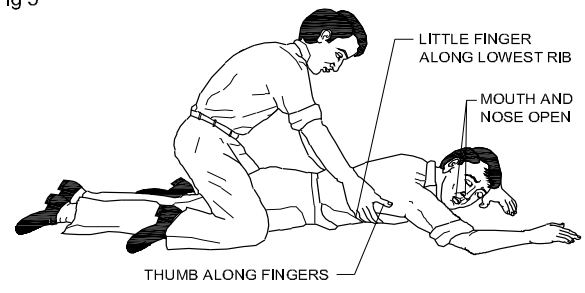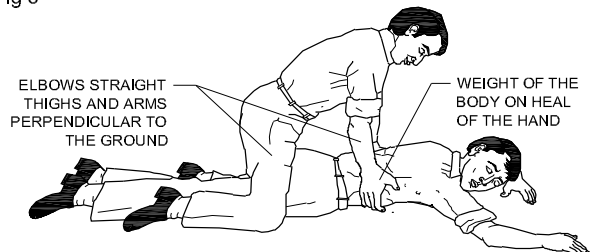
EMN1104H6

c **Mouth-to-Mouth Process (method)**

> • **Be brisk in carrying out this method but avoid violent operations which may cause injury to the internal parts of the victim.**

1 Remove loose dentures or other obstructions from the mouth. Make sure that the victim's nose and mouth are clear.

2 Lay the victim flat on his back. Place a roll of clothing under his shoulders such that his head is thrown well back as shown in Fig 7.

Fig 7

EMN1104H7

3 Tilt the victim's head back so that the chin points straight upward.

4 Grasp the victim's jaw as shown in Fig 8 and raise it upward until the lower teeth are higher than the upper teeth. Maintain this position throughout the artificial respiration to prevent the tongue from blocking the air passage.

Fig 8
CHIN STRAIGHT UPWARDS
LOWER TEETH ARE HIGHER THAN UPPER TEETH
HEAD BACK
EMN1104H8
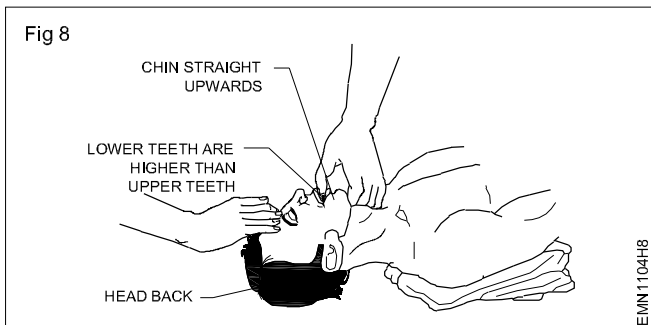
5 Take a deep breath and place your mouth over the victim's mouth as shown in Fig 9 making airtight contact. Hold the victim's nose shut with the thumb and forefinger. Blow into the victim's mouth (gently in the case of infants) until his chest rises. Remove your mouth and release the hold on the victim's nose. If you dislike direct contact, place a porous cloth between your mouth and the victim's mouth.

Fig 9
NOSE PINCHED
AIRTIGHT CONTACT OF TWO MOUTHS
EMN1104H9
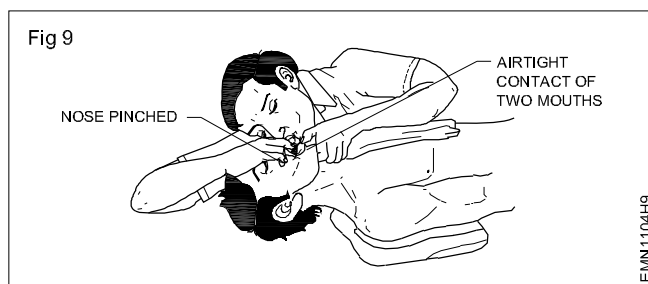
6 If air cannot be blown in, check the position of the victim's head and jaw. Check the mouth for obstructions (block). Then try again blowing air more forcefully. If the chest still does not rise, turn the victim's face down and strike his back sharply to dislodge obstructions.

7 Let the victim exhale. Hear the out rush of air from the victim's mouth and nose. Sometimes air enters the victim's stomach as evidenced by a swelling stomach. Expel the air by gently pressing the stomach during the exhalation period.

8 Repeat steps 5 and 7, eight to ten times rapidly. Then slow down to 10-20 times a minute. (20 times for infant). Sometimes it may take hours for the victim to breathe normally. Continue giving artificial respiration till he recovers.

— — — — — — — —

Preventive measures for electrical accidents & steps to be taken in such accidents

Objectives: At the end of this exercise you shall be able to
• **prevent electrical accidents**
• **following the steps to be taken in electrical accidents.**

PROCEDURE

TASK 1: **Prevention of electrical accidents**

1 Keep the work area clean.

2 Use licensed electrical and electronics items only.

3 Ensure that before touching the body of equipment there is no leakage of electric current in it.

4 Before starting the maintenance or repair work on any equipment, either disconnect it from the mains supply or keep yourself isolated from the earth contact by using rubber shoes, rubber matting or dry-wooden board/stool.

6 necessary instruments, circuits, etc. and arrange them on the table as per the sequence of requirement.

7 Select proper insulated tools for the job, clean and restore the same to its place after use.

8 Always disconnect the equipment to be repaired from the mains line by pulling the plug-top and not by pulling the power cord.

9 Always discharge high voltage filter capacitors after opening the equipment and before starting repairs by short circuiting the capacitor terminals with a piece of thick wire.

10 Keep yourself away from the Extra High Tension (EHT) points while the TV receiver is "ON" because 12KV to 25KV EHT remains present on the picture tube and the same can give you a severe electric shock.

11 Always use a 25 Watts or 35 Watts soldering iron while working on a Printed Circuit Board (PCB). The use of more wattage soldering iron can damage the PCB line as well the component.

12 Replace or remove fuses only after switching OFF the circuit / equipment.

— — — — — — — —

TASK 2: **Steps to be taken during the occasion of electrical accidents**

1 Do not touch the victim or the equipment/appliance which is under accident.

2 Unplug the equipment/appliance or turn OFF the mains power.

3 In case you can't turn off the power, use a piece of wood, like a broom handle, dry rope or dry clothing, to separate the victim from the live line.

4 Call the doctor immediately. Even if the victim's breathing and heartbeats have recovered, do not delay in calling a doctor for a check-up and treatment.

5 Keep the victim lying down; Unconscious victim should be placed on their side to allow any fluid coming out from mouth to drain.

6 If the victim is not breathing, apply mouth-to-mouth resuscitation. If the victim has no pulse, begin cardiopulmonary resuscitation (CPR). Then cover the victim with a blanket to maintain body heat, keep the victim's head low and get medical attention.

7 After the victim has recovered, keep the victim warm with blanket, wrapped up with hot water bags. Stimulate circulation by stroking the inside of the arms and legs towards the heart.

8 Do not give the victim any stimulant such as coffee, tea etc., until he is fully conscious.

— — — — — — — —

Use of fire extinguishers

Objectives: At the end of this exercise you shall be able to
• identify the types of fire
• select the proper type of fire extinguisher
• use of the fire extinguishers.

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees tool kit - 1 Set • Different type of Fire extinguishers - 1 No (each)	• Scrap material like Wood / Wire pieces/Oil/Cotton cloth - 1 kg • Match Box - 1 No

PROCEDURE

TASK 1: **Identification of types of Fire and Fire Extinguisher to be used**

1 If an electrical system begins sparking or a fire ignites at a wire, appliance, or outlet, then cutting the power to the system is the first as well as best step to take.

2 Identify the type of fire like Class-A (Wood, paper cloth), Class-B (Flammable Liquid & Liquefiable solids), Class-C (Gas and liquefied gas), etc.

3 Based on the type of fire, identify the type of fire extinguisher is to be used like, Dry Powder Fire Extinguisher, Foam type Fire Extinguisher, Carbon-di-oxide Fire Extinguisher, Water Fire Extinguisher, etc.

TASK 2: **Using Procedure of Fire Extinguisher**

1 Stand with your back to an exit as shown in figure.

2 To employ the extinguisher with proper technique, just remember the acronym "PASS."

      P - Pull

      A - Aim

      S - Squeeze

      S - Sweep
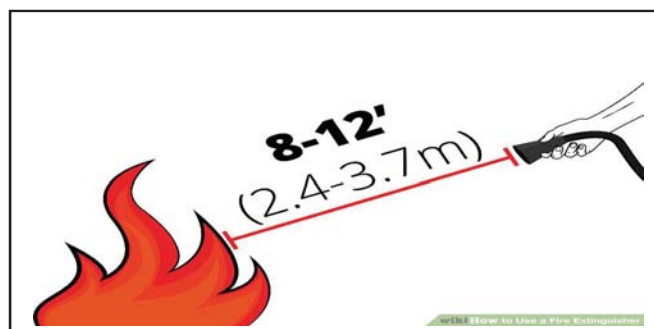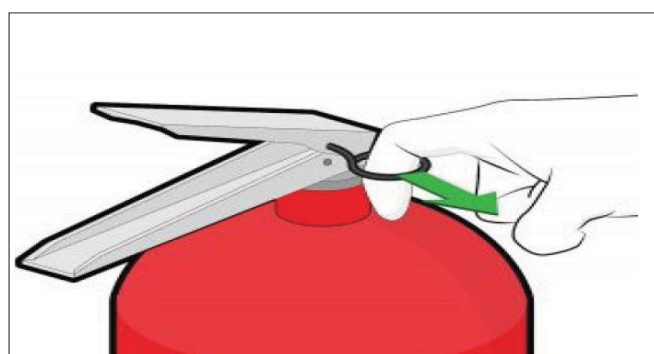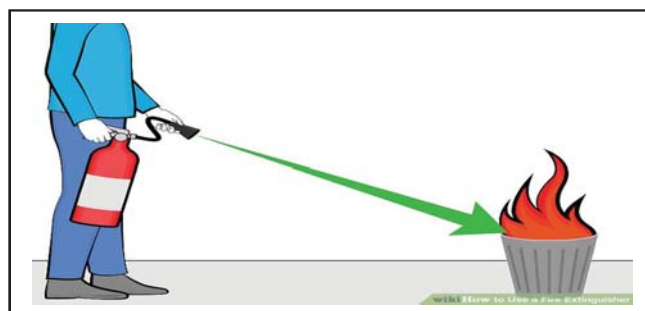
3 **Pull** the safety pin of the Fire extinguisher.

4 **Aim** the nozzle at the base of the fire. Hitting the tops of the flame with the extinguisher won't be effective.

5 **Squeeze** the trigger. In a controlled manner, squeeze the trigger to release the agent.

6 **Sweep** from side to side. Sweep the nozzle from side to side until the fire is put out. Keep aiming at the base while you do so. Most extinguishers will give you about 10-20 seconds of discharge time.

7 Get the work checked by the Instructor.

Identify the different hand tools

Objectives: At the end of this exercise you shall be able to
• **identify the different types of hand tools**
• **record the specification of the hand tools.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**

Tools/Equipments/Instruments

• Trainees tool kit   - 1 Set

Materials/Components

• Cotton Waste   - ½ kg
• Emery sheet   - 1 No

PROCEDURE

• **The Instructor has to label the tools used for this exercise.**

• **And also arrange for tools and the required materials from scrap for practicing the functioning of tools.**

1 Pick one of the labeled hand tools from the Workbench.

2 Identify and record the name of the labeled hand tool in Table - 1.

3 Measure the size and record the specification of the hand tool in the Column-3 of the table.

4 Draw the outline sketch of the hand tool in Column-4 of the table.

5 Repeat step-2 to 4 for the remaining hand tools.

6 Get the work checked by the Instructor.

Table - 1

Label No.	Name of the Tools	Specification	Sketch of Tool
1	Screw Driver		
2	Star Screw Driver		
3	Line Tester		
4	Instrument Screw Driver		
5	Long Nose Plier		
6	Combination Plier		
7	Side Cutting Plier		
8	Wire Stripper		
9	Scriber		
10	Hack Saw Frame		
11	Ball Pein Hammer		
12	Chisel		
13	Soldering iron stand		
14	Soldering Iron		
15	De-soldering Pump		
16	Flat File		
17	Round File		
18	Tweezer		
19	Magnifying Glass		
20	Cleaning Brush		
21	Steel Rule		

11

Selection of proper tools for operation and precautions in operation

Objectives: At the end of this exercise you shall be able to
- **select proper tools for operation**
- **use the hand tools with precautions.**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Cotton Waste	- ½ kg
• Different types of tools used in Electronics work	- 1 No (each)	• Emery sheet	- 1 No

PROCEDURE

> **The instructor has to arrange the tools and required materials for practicing the functioning of tools. The Instructor has to label the tools used for this exercise.**

1 Pick one of the labeled hand tools from the Workbench.

2 Identify and record the name of the hand tool in Table - 1

3 List the use/application of the tool in Column-3 of the table.

4 Record the precautions involved while operating the tools in Column-4 of the table.

5 Repeat step-2 to 4 for the remaining hand tools.

6 Get the work checked by the Instructor.

Table - 1

Label No.	Name of Tools	Uses/applications	Precautions
1	Screw Driver		
2	Star Screw Driver		
3	Line Tester		
4	Instrument Screw Driver		
5	Long Nose Plier		
6	Combination Plier		
7	Side Cutting Plier		
8	Wire Stripper		
9	Scriber		
10	Hack Saw Frame		
11	Ball Pein Hammer		
12	Chisel		
13	Soldering iron stand		
14	Soldering Iron		
15	De-soldering Pump		
16	Flat File		
17	Round File		
18	Tweezer		
19	Magnifying Glass		
20	Cleaning Brush		
21	Steel Rule		

Care & maintenance of trade tools

Objective: At the end of this exercise you shall be able to
• **learn and practice care and maintenance of hand tools.**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Cotton Waste	- ½ kg
		• Emery sheet	- 1 No
		• Lubricating Oil	- ½ Lt

PROCEDURE:

1 Keep the tools in a Dry Place.

2 Wipe or clean after every use with a clean and soft cloth to remove dirt/ dust.

3 Keep all the tools in a tool room / tool rack.

4 Store power tools in their original cases.

5 Apply the recommended appropriate oil to prevent the tools from rusting.

6 Use silica gel packs

7 Do not use knife, screw driver, hammer etc., without a handle. A tool without a handle should not be used.

8 While giving a tool to another person, always give it through its handle side.

9 During rainy season, fine layer of oil or grease should be applied to the appropriate metallic parts of tools.

10 If a layer of oil or grease is present at the handle of a tool then it should be cleaned off first with a piece of cloth soaked in kerosene oil or petrol, and then the same should be used.

11 A plier should not be used like a hammer and its insulating cover should be preserved.

12 Never use screwdrivers as wood chisel or cold chisel.

13 Steel wires should not be cut with a side cutter.

14 A neon tester should not be used as a screw driver.

15 A knife should not be used for cutting wires. It should be used only for scrapping the insulation of wires.

16 A hacksaw blade should be well tight in its frame and it should cut the metal in its forward stroke.

17 Before using a drilling machine, check that the drill bit is properly tighten.

18 Do not use a soldering iron of more than 15 to 25 watts while working on a circuit containing transistors and ICs.

19 Keep the soldering iron's bit clean and maintain its shape.

20 Use plastic and Bakelite screw drivers for the 'Alignment' job of a radio or TV receiver.

— — — — — — — —

Practice safety precautions while working in fitting jobs

Objective: At the end of this exercise you shall be able to
• **state and practice safety precautions while working in fitting jobs.**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Cotton Waste	- ½ kg
		• Emery sheet	- 1 No

PROCEDURE:

Follow the safety precautions in the fitting workshop

1 Ensure that the handle of file is fitted tightly.

2. Fix the work piece in the vice clamped correctly.

3 Never use hammers with loose heads.

4 Use the proper tool for the job.

5 Do not use a spanner as hammer.

6 Do not use a steel rule as a screw driver.

7 Use coolant at the time of hack - sawing and drilling.

8 Clean the work place after each work and keep neat.

— — — — — — — —

14

Workshop practice on filing and hacksawing

Objective: At the end of this exercise you shall be able to
• **hold different section of job for hacksawing**
• **cut the job using hacksaw**
• **file the job piece for smoothing the surface.**

Requirements		
Tools/Equipments/Instruments		**Materials/Components**

Tools/Equipments/Instruments

• Trainees tool kit   - 1 Set
• Engineer's Steel Rule 300 mm   - 1 No
• Metallic Scriber 150 mm   - 1 No
• Hacksaw frame with Blade 30 mm - 1 No
• Flat file 300 mm   - 1 No
• Half Round file 300 mm   - 1 No

Materials/Components

• Hylam Board, 2mm Thick   - 1 Sq.ft
• Sand paper, No. 60 grade   - 1 No
• Cotton waste   - ½ kg

PROCEDURE

The Instructor has to give a dimension for the job of hack saw cutting on the Hylam board.

TASK 1: **Marking of Hylam Sheet**

1 Take the Hylam sheet and clean by using dry cloth/ paper.

2 Use the Steel Rule and scriber, mark the given dimensions on the hylam sheet.

3 Get the work checked by the Instructor.

— — — — — — — —

Safety: Hold the hacksaw frame firmly and carefully.

TASK 2: **Cutting of Hylam Board using Hacksaw**

1 Fix the job piece in the bench vice tightly.

2 Fix the hacksaw blade into the frame with proper direction.

3 Using hacksaw, cut the hylam board at the markings.

Note: When sawing with the hand hacksaw start the movement from the arms and is assisted by a corresponding movement of the body.

4 Make forward stroke with pressure on the handle by pushing the hack saw for cutting.

5 Make return stroke without pressure by pulling the handle to move backwards.

6 Move the full length of the saw blade for cutting in forward stroke

7 Saw correctly in a straight line along the marked line.

8 Get the work checked by the Instructor.

— — — — — — — —

TASK 3: **Filing the job**

1 Hold the job in the bench vice with a projection of 5 to 10 mm from the top of the vice jaw.

2 Select flat files of various grades and length according to the, size of the job, quantity of metal to be removed/ material of the job.

3 Hold the handle of the file and push the file forward using your hand palm.

4 Hold the tip of the file according to the quantity of the metal to be removed for heavy filing or light filing or for removing local unevenness.

5 Start filing by pushing the file uniformly during the forward stroke and release the pressure during the return stroke.

Note: Continue giving strokes. Balance the pressure of the file in such a way that the file always remains flat and straight over the surface to be filed.

6 Check the surface and continue filing if required.

7 Get the work checked by the Instructor.

— — — — — — — —

Practice simple sheet metal works, fitting and drilling

Objective: At the end of this exercise you shall be able to
• **mark, cut, bend and assemble a sheet metal work.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees tool kit	- 1 Set	• Aluminium sheet 2mm Thick	- 1 Sq. ft
• Engineer's Steel Rule 300 mm	- 1 No	• Sand paper No 6 grade	- 1 No
• Metallic Scriber 150 mm	- 1 No	• Cotton waste	- ½ kg
• Hacksaw frame with Blade 300 mm	- 1 Set	• Rivet (size and number as per	
• Flat file 300 mm	- 1 No	the job drawing)	- as reqd
• Half Round file 300 mm	- 1 No		
• Shearing Machine	- 1 No		
• Press Break	- 1 No		
• Centre punch	- 1 No		
• Ball pein hammer	- 1 No		
• Electrical hand drilling machine	- as reqd		

PROCEDURE

1 **Marking:** Mark the required dimensions and holes where to be made using steel rule and scriber. Mark the line for rivet/weld on the sheet metal.

2 **Cutting:** Cut a large sheet into smaller rectangles using a shearing machine or snips.

3 **Punching:** Punch the centre points of the holes to be drilled lightly using a centre punch and hammer.

4 **Drilling:** Place the sheet on the workbench and drill the required holes using portable drill machine. If the sheet is thick and hard, then make holes using bench drilling machine.

> **Safety precaution:**
>
> • **Turn OFF the drilling machine when fixing/ changing Drill Bits. Ensure that the Chuck is tight before Using the Drill.**
>
> • **Hold the sheet metal when marking/cutting/ punching or drilling operations bending.**

5 **Bending:** Position the sheet on the Press break so the bend line is above a vee-shaped channel then brings down the bending tool. This pushes the sheet into the vee and the sides of the blank move up as the bend is formed. Hold the Sheet Parallel to the Bender

6 **Assembling:** Each piece of the assembly is held in position with clamps. Then tack weld or rivets or screwing are made to hold everything together.

> **Wear safety glasses to protect your eyes from flying debris.**

7 **Finishing:** After assembly or joining most fabrications get some finishing. This ranges from cleaning up welds to polishing to a mirror finish, range of painting and coating options. These usually have two objectives: protect the fabrication against corrosion, and provide whatever finished appearance is needed.

— — — — — — — —

Make an open box from metal sheet

Objective: At the end of this exercise you shall be able to
• **make an open box using metal sheet.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Engineer's Steel Rule, 300 mm	- 1 No
• Metallic Scriber, 150 mm	- 1 No
• Hacksaw frame with Blade, 300 mm	- 1 Set
• Flat file, 300 mm	- 1 No
• Portable Drilling Machine	- 1 No
• Shearing Machine/Beverly shears	- 1 No
• Press Break	- 1 No
• Centre punch	- 1 No
• Ball pein hammer	- 1 No
• Mallet	- 1 No

Materials/Components

• 20 SWG sheet Metal	-1 Sq.ft
• Sand paper No 6 grade	- 1 No
• Cotton waste	- ½ kg
• Rivet (size and number as per the job drawing)	- as reqd
• Card board sheet	- as reqd

PROCEDURE

1 Make an expanded template for the box using cardboard, paper, etc.

2 Trace the template on to the piece of sheet metal.

3 Cut the piece into the same shape as template. Use the corner notches to cut out any right angles, but be sure to line it up exactly on the lines. Use the Beverly shears to cut off the small corners.

4 Drill 2mm diameter holes using portable drilling machine on all corners of box.

5 Now the sheet metal is ready to start bending.

6 Bend the sheet metal to 90° at all the four corners using a wooden mallet.

> **Ensure the overlap parts are well within the bending lines of the side.**

7 After finishing the bending work at all the four sides up, assemble the box using spot welder or rivet to hold all the sides in place.

8 Get the work checked by the Instructor.

— — — — — — — —

Identify the phase, neutral and earth on power socket use testers to monitor AC power

Objectives: At the end of this exercise you shall be able to
• **test and identify phase, neutral and earth terminals of a single phase AC mains 3 - pin socket using.**
   1 test lamp
   2 neon tester

Requirements	
Tools/Equipments/Instruments	**Materials/Components**

• Trainees Tool Kit - 1 Set
• Neon tester, 500 V - 1 No
• Digital multimeter with probes - 1 No
• Test lamp with holder and grill - 1 No
  (240V AC/60 Watt)
	• PVC wire (1.5 sq.mm) - 1 m
	  Red colour, (5/20 gauge) - 1 m
	  Black colour, (5/20 gauge)
	• Incandescent bulb 60 watts/250 V - 1 No
	  (per batch) - 1 No
	• Sketch pen - 1 No

PROCEDURE

> **Safety precaution: Be cautious and safety from electrical shock.**

TASK 1: **Fix the grill on the holder to prevent damage to bulb**

1 Make a test lamp setup as shown in Fig 1

Fig 1
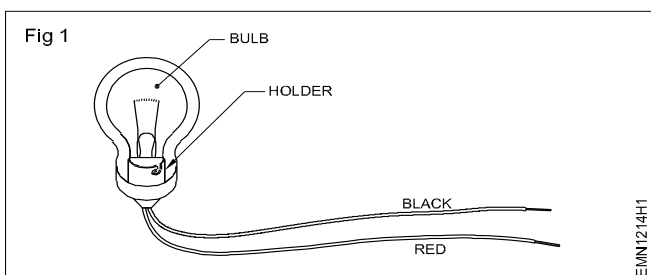
2 Test the continuity at the free ends using an ohmmeter to confirm correct wiring and connections of the test lamp.

3 Mark terminal sockets on the 3 - pin 230V, AC mains socket to identify phase, neutral and earth points as A, B and C using sketch pen as shown in Fig 2.

4 Switch ON the AC supply to the 3 pin socket.

5 Connect the test lamp across the 3 -pin socket outlet points (A&B) and check the presence of mains supply.

Fig 2
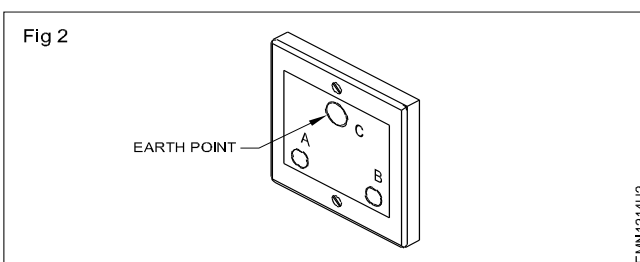
6 Record the observation in Table - 1

- If supply does not exist (lamp does not glow), consult your instructor before carrying out further steps.

- If lamp glows, the outlet point B is Phase or Live (L) mark outlet B as 'L' using sketch pen. Repeat steps 5 and 6 with the test lamp across Earth and socket B

7 Repeat steps 5 & 6 with test lamp across A - C and if lamp does not glow, the other point A is neutral (N) mark it as N.

Table - 1

SI No.	Measurement across			Lamp condition	Remarks
	A- B	**B - C**	**C- A**		
1		-	-		
2	-		-		
3	-	-			

8 Get the work checked by the Instructor.

> **Note: If the mains supply circuit is provided with ELCB, it may break the circuit when the test lamp in connected across the line L and earth E**

Construct a test lamp and use it to check mains healthiness

Objectives: At the end of this exercise you shall be able to
• **construct a test lamp**
• **check mains healthiness by using the test lamp.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit   - 1 Set
• Digital multimeter with probes   - 1 No

Materials/Components

• PVC wire,
  Red colour, (5/20 gauge)   - 1 m
  Black colour, (5/20 gauge)   - 1 m
• Incandescent bulb 60W/250V   - 1 No

PROCEDURE

> **Safety precaution: Be cautious and your safety from electrical shock is your responsibility.**

1 Skin the terminals of PVC wire and connect them into pendent lamp holder.

2 Fix the 60 watt bulb into the lamp holder.

3 Use ohm meter test and ensure continuity of the constructed test lamp as shown in Fig 1.

Fig 1

BLACK

RED

EMN1215H1
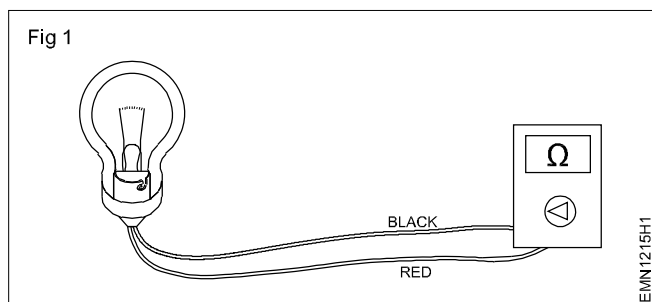
4 Connect the test lamp across live and neutral terminals of AC mains supply point.

5 Switch ON the mains supply and observe the brightness of lamp.

6 Record the observation of mains healthiness as good in Table - 1

Table - 1

Lamp brightness		Mains healthiness
OK	**Not OK**	

7 Get the work checked by the Instructor.

— — — — — — — —

Measure the voltage between phase and ground and rectify earthing

Objectives: At the end of this exercise you shall be able to
• **measure the voltage between phase to ground and detect the fault**
• **rectify defective earth connection.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Digital multimeter with probes	- 1 No
• Test lamp	- 1 No

Materials/Components

• Sketch pen	- 1 No

PROCEDURE

> **Safety precaution: Be cautious when working on live Ac mains supply**

TASK 1: **Measurement of voltage between phase and ground terminals**

1 Identify the phase and earth terminals of 3 pin AC 230V socket outlet.

2 Mark the three terminals as L.N & E using sketch pen

3 Switch ON the mains supply to the 3 pin socket.

4 Select AC voltage range on the DMM and measure voltage across 'L' and 'E' terminals as shown in Fig 1.

5 Record the observation in Table - 1.

Fig 1
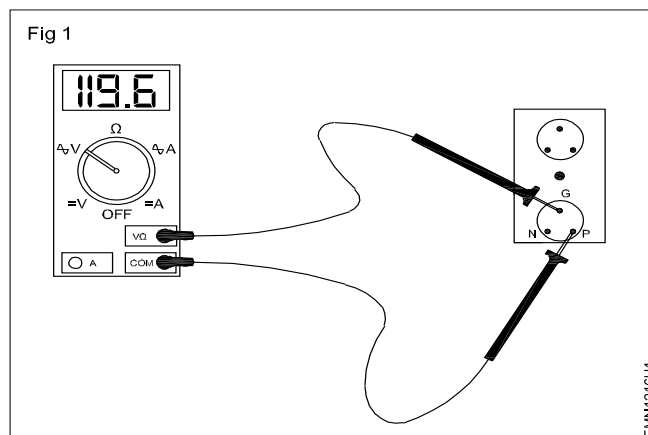
Table - 1

SI No	AC voltage measured across terminals		Remarks
	L to E	**L - N**	
1			
2			

6 Get the work checked by the instructor.

TASK 2: **Rectification of the defective earth.**

1 Connect test lamp between the earth and phase terminals socket.

2 Observe the condition of the brightness in the lamp.

3 Connect the test lamp between L and N terminals and confirm the lamp glowing.

4 Switch OFF the mains supply, remove the 3 pin socket and observe the wire connection on the earth terminal.

5 Check and ensure the continuity of the wire to the earth pit on the ground.

6 Check the continuity between the earth electrode and wire conductor.

7 Remove the bolt & nut clean the corrosion on the electrode contact terminal.

8 Refix the earth wire connection to the electrode. (Use new bolt & nut if the old is more corroded).

9 Check the continuity from earth electrode to the 3 pin socket terminal.

10 Switch ON power use test lamp, and measure voltage across 'L' and 'E' terminals record your observations.

11 Get the work checked by the Instructor.

— — — — — — — —

Identify and test different AC mains cables

Objectives: At the end of this exercise you shall be able to
• **identify different types of AC mains cables**
• **test different AC mains cable.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Digital multimeter with probes	- 1 No

Aids: Chart showing different types of cables

Materials/Components

• 5 core cable	- 1 m
• 4core cable	- 1 m
• 3 core cable	- 1 m
• 2 core cable	- 1 m
• Cotton waste	- as reqd
• Cotton cloth	- as reqd

PROCEDURE

Note: The instructor has to select the types of cables for this exercise and label them using numbers

TASK 1: **Identification of types of cables**

1 Pick one of the labelled cable from given lot, identify the number of cores, their colours and number of conductors in each core.

2 Record the observations in Table - 1 (Refer to the chart to identify the name of cable)

Fig 1

5 CORE CABLE

EMN1217H1

Fig 2

4 CORE CABLE

EMN1217H2

Fig 3

3 CORE CABLE

EMN1217H3

Fig 4

2 CORE CABLE

EMN1217H4
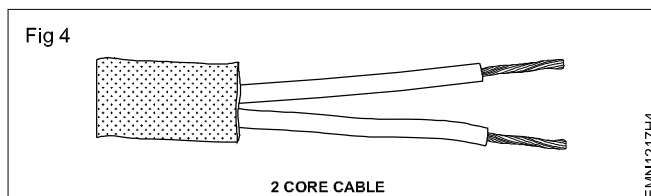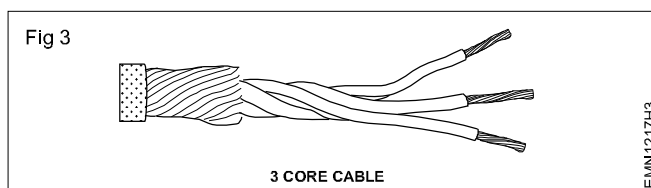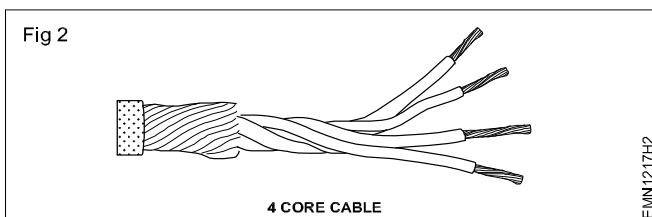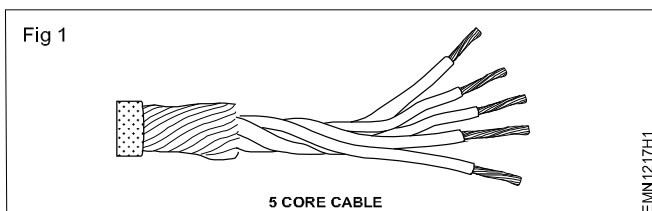
3 Repeat steps 1 & 2 for remaining labelled cables.

4 Check the continuity of each core of above cables and record your observations in Table 1

Table - 1

Sl. No.	Label No.	No of Cores	Colours	No of Strands	Type name	Value in ohms	Remarks
1							
2							
3							
4							
5							

5 Get the work checked by the instructor.

— — — — — — — —

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TASK 2: **Testing of different AC mains cables**

1　Connect the each cable ends between the proper terminals of multimeter for continuity test as shown in Fig 5.

2　If the reading shows zero, then there is continuity in the cables. If it shows infinity, there is a break in the cable.

Fig 5

　Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.2.17
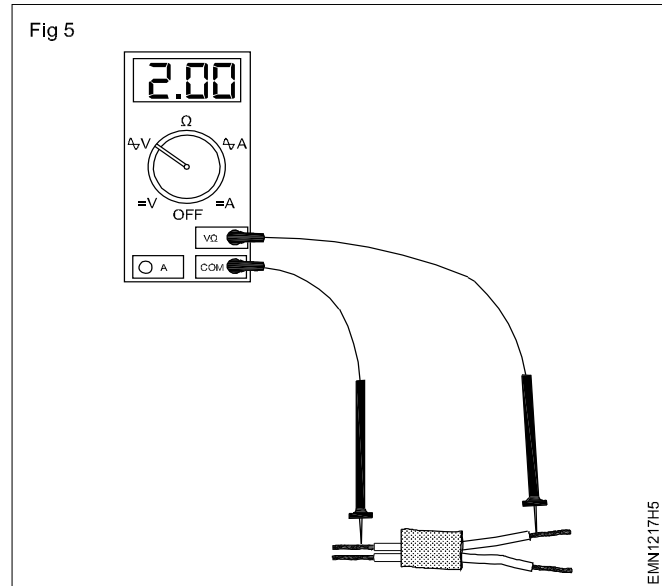
Prepare terminations, skin the electrical wires / cables using wire stripper and cutter

Objectives: At the end of this exercise you shall be able to
• **skin (cut and remove) the insulation of cables using manual stripper**
• **skin the insulation of two core cable using auto ejection type wire stripper**
• **remove the insulation of the PVC sheathed cable using side cutting pliers**
• **terminating wire end with crocodile clip and banana plug**
• **terminating skinned cable to three pin mains plug.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit   - 1 Set
• Wire stripper: manual & auto
  ejection type   - 1 each
• Diagonal cutting pliers 150 mm   - 1 No

Materials/Components

• Copper and aluminium cables of the
  following sizes:
• PVC single strand 1.5 sq. mm   - 3 m

• PVC single strand 2.5 sq. mm   - 3 m
• PVC cable 14/0.2 mm   - 3 m
• PVC cable 21/0.2 mm   - 3 m
• PVC cable 40/0.2 mm   - 3 m
• Crocodile clips (Black x Red)   - 2 Sets
• PVC insulated and PVC sheathed
  cable single core   - 3 m
• Two core PVC cable (250V/ 6A)   - 1 m
• 3 core PVC cable   - 1 m
• 3 pin electrical mains plug 250 V/6A - 1 No
• Cut pieces of flat twin core cable   - 3 m

PROCEDURE

TASK 1: **Skinning the cable insulation using a manual wire stripper**

1 Pick one of the labelled cable.

2 Straighten the cable ends at which insulation is to be skinned.

3 Mark the point 10 mm from which the insulation is to be skinned on both the ends of the cable.

4 Adjust the jaws of the manual stripper to suit the gap equivalent to the size of the conductor core. (Fig 1a and 1b) and set the stop position of the screw

5 Hold the cable firmly in one hand, set the jaws at the mark, press the handle of the stripper and make a cut on the insulation.

> **Safety: Exercise care, not to nick the conductor. For better practice try on small waste pieces of wires.**
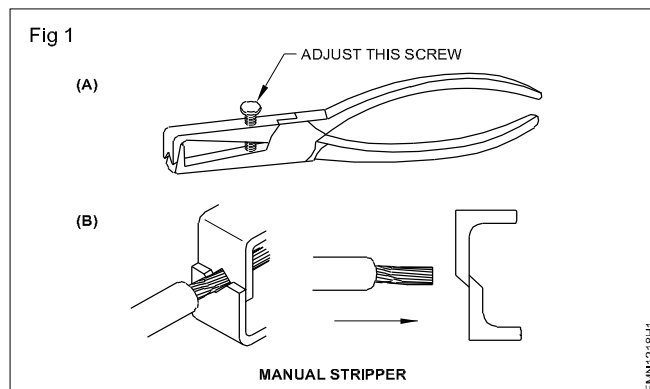
6 Pull the stripper to remove the insulation.

7 Get the work checked by the Instructor.

— — — — — — — —

TASK 2 : **Skinning the cable insulation using an auto ejection type wire stripper**

1 Repeat steps 1 to 3 of Task - 1

2 Take the auto ejection type wire stripper and jaws, slots for various diameter markings. (Fig 2 and 3)

3 Select a slot in the jaws whose diameter is equal to the conductor core

> **Safety Precaution: While using this stripper the cable insulation should be put in the proper slot to avoid damage to the conductor.**

4 Place the marked point of cable at the jaws of the stripper exactly at the slot.

5 Hold the cable firmly in one hand and press stripper handles till the insulation is cut and removed from the cable end.

6 Repeat the above steps to skin the other ends of the cables

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Fig 2

AUTO - STRIPPER

EMN1218H2

Fig 3

A   0.5 1.2 1.6 2.0

B   1.0 1.5 2.0 2.6 3.2

JAWS OF AN AUTO STRIPPER

EMN1218H3
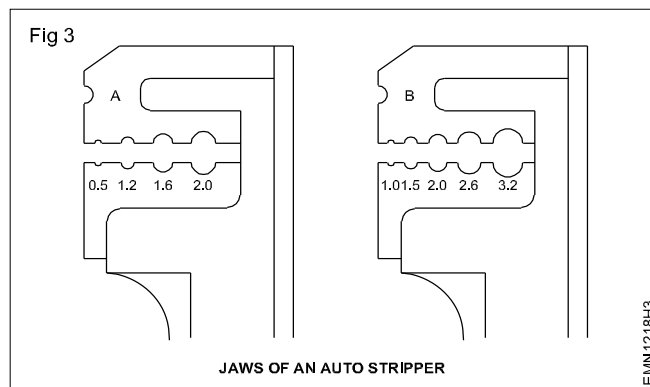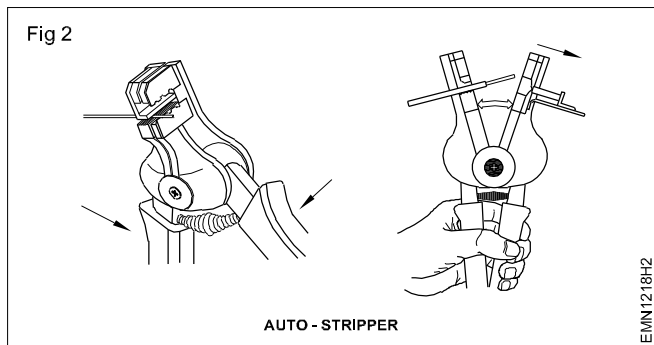
7   Get the work checked by the instructor.

— — — — — — — —

TASK 3 : **Skinning the insulation of three core cable**

1   Mark out the length up to which the insulation has to be removed from the cable end.

2   Hold the cable firmly, place the electrician knife on the marking of the sheath or insulation of the cable to be removed.

3   cut the insulation to a depth of approximately 1 mm thickness of the sheath or insulation carefully.

> **Safety precaution: Use the knife carefully. By cutting too deep into the insulation or sheath of a cable will damage the insulation of wires inside the cable. Avoid deep cutting (Fig 4).**
>
> **This causes short circuit and breakdowns in electrical installations.**

Fig 4

INSULATION OF THE CABLE DAMAGED DUE TO DEEP CUT

EMN1218H4
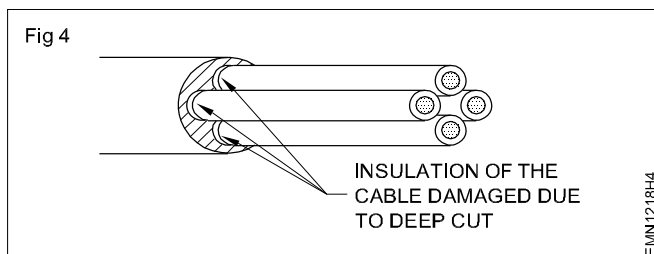
4   Place the cable end on table top, use the knife, slit open the sheath or insulation between the circular cut you have made at the end of the cable, as shown in (Fig 5).

Fig 5

CUT ALONG THE CENTRE OF THE CABLE

EMN1218H5

> **Here again be very careful not to cut the insulation of wires inside the cable.**

Alternative method - using diagonal cutting pliers.

1   Cut the covering from the marked end up to the length it should be removed by using side cutting pliers as shown in Fig 6.

Fig 6

INSULATION REMOVAL BY A SIDE CUTTING PLIER

EMN1218H6
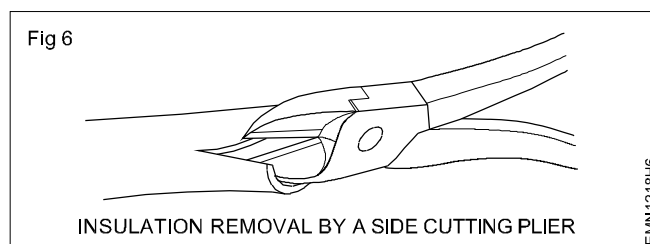
2   Cut the sheathing along the circumference as shown in Fig 7.

Fig 7

EMN1218H7

3   Get the work checked by the Instructor.

— — — — — — — —

TASK 4 : **Terminating wire end with crocodile clip and banana plug**

1   Take a piece of tinned red wire and a red crocodile clip.

2   Unscrew and take out the screw and washer from the crocodile clip.
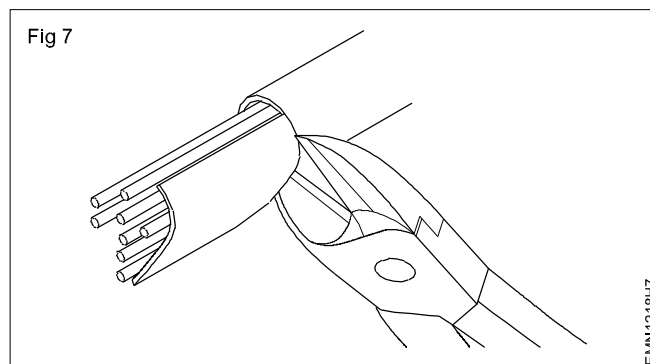
3   Insert the tinned end of the wire through the leg of the crocodile clip as shown in Fig 8.

Fig 8
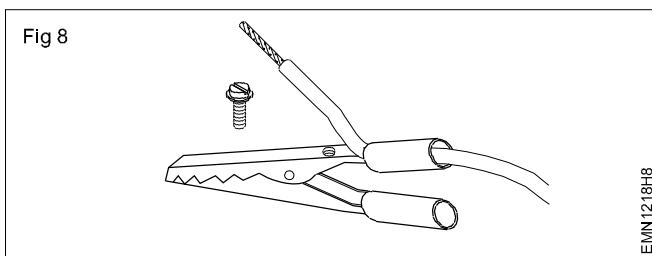
4   Bend the tinned exposed conductor to form a loop using a round nose plier. Place the loop in the screw, such that the loop is in the direction of screw as shown in Fig 9

Fig 9
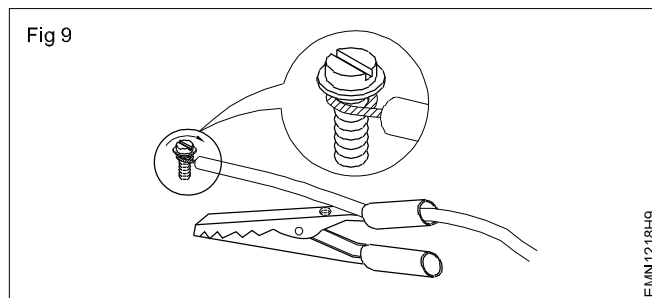
5   Put the screw back on the crocodile clip and tighten the screw firmly. While tightening hold the wire such that wire does not protrude below the screw washer.

Excessive wire protrusion results in weak termination. Hence, the termination may come out during usage.

6   Take a red colour banana plug, unscrew the loosen screw on it almost fully but do not take out the screw from its place.

As the screw is small it will be time consuming to replace the screw back in its position if taken out from the plug.

7   Bend the other free end of the tinned wire by hand or using a nose pliers such that it takes the shape of a loop and Insert the loop fully into the hole of the banana plug as shown in Fig 10 and tighten the screw firmly. Hold the wire with the body of the banana plug such that the wire does not slip off while tightening.

Fig 10
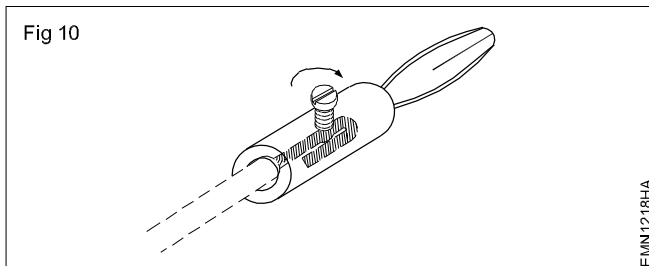
8   Holding the banana plug in one hand and the wire in the other pull the wire gently to ensure that the termination is firm. If termination is found loose, unscrew the screw, pull out wire and repeat steps 7.

9   Follow steps 1 to 8 above and prepare a black wire termination with crocodile clip to banana plug.

10 Repeat the steps 1 to 8 and terminate different wires as shown in Fig 11.

Fig 11
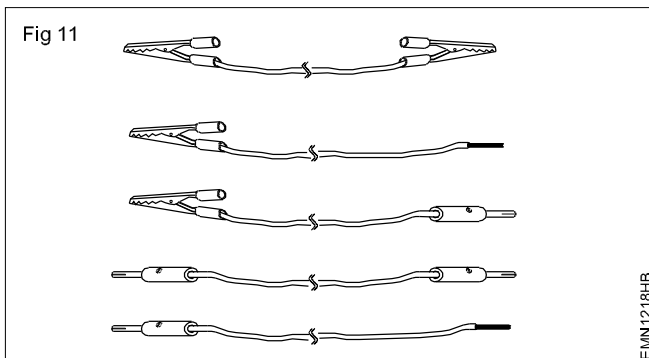
11 Get the work checked by the Instructor.

— — — — — — — —

TASK 5: **Terminating skinned Cable to three pin mains plug**

The steps given below are for the most common type of three-pin PLUGS. For other types the steps may vary slightly. Consult the instructor in case of difficulty.

1   Open the outer plastic casing of the 3 pin plug. Remove the cable grip and place them safely in a tray or screw box.

2   Ensure the length of the outer sheath skinned is equal to the distance between the earth terminal and the cable grip as shown in Fig 12.

3   Remove the anti-king shroud (anti-king ring) from the plug and take the cable through it as shown in Fig 13.

Fig 12

Fig 13
ANTI - KING SHROUD
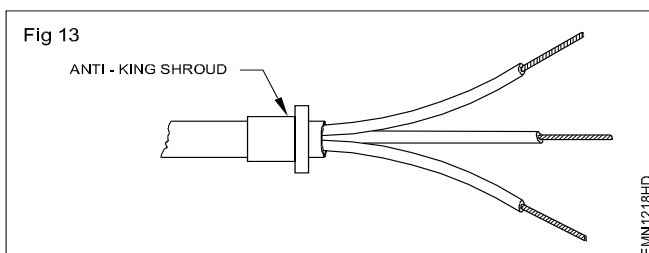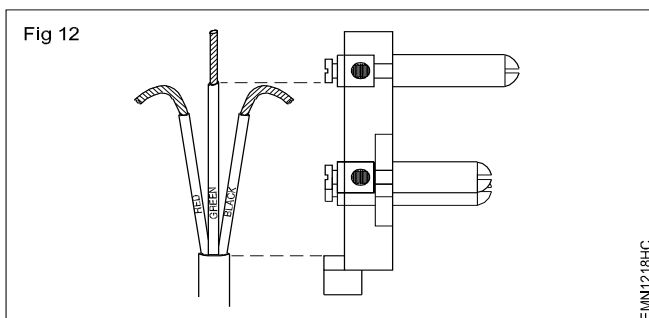
4   Make loops of the tinned conductor end of wires Loosen the screw insert the red wire loop into terminal marked L or Live as shown in Fig 14a and tighten the terminal screw.

5   Insert the black/blue wire loop into the terminal marked N or Neutral and the green wire loop to the earth terminal as shown in Fig 14b and tighten screws.

Fig 14

(a)   (b)

EMN1218HE
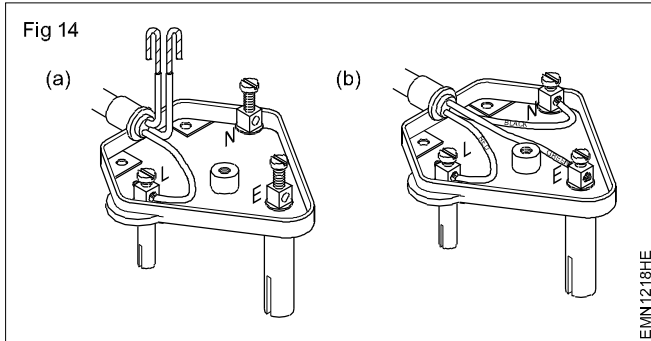
6   Position the anti-king shroud, reassemble the cable grip rubber and its screws.

7   Get the work checked by the instructor.

8   Reassemble the top cover of the plug. The finished work should look as shown in Fig 15.

Fig 15

EMN1218HF
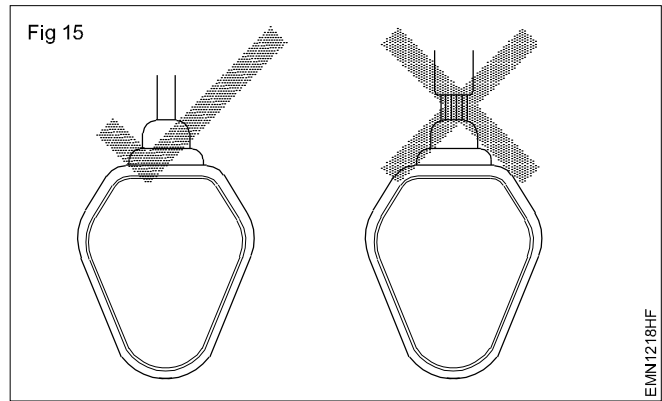
The cables terminated with 3 pin main plug made in this exercise will be used in further exercises.

— — — — — — — —

Measure the gauge of the wire using SWG and outside micrometer

Objectives: At the end of this exercise you shall be able to
• **measure the gauge of the wire using**
   a) standard wire gauge (SWG)
   b) outside micrometer.

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Standard wire gauge (per batch)	- 1 No
• Outside micrometer 0-25 mm (per batch)	- 1 No
• Pocket table book / wire table	- as reqd

Materials/Components

• Single strand wire pieces (assorted sizes)	- 2 Nos
• Rigid multistrand wire piece	- 1 No
• Flexible multi strand wire pieces	
- Red colour	- 1 No
- Black colour	- 1 No
- Green colour	- 1 No
• Dry cloth	- as reqd

PROCEDURE

Note: The Instructor has to attach labels to identify each piece of wire correctly as shown in Fig 1.
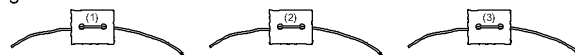
Fig 1

TASK 1: **Measurement of gauge number of wire using standard wire gauge**

1 Clean the skinned end of single strand wires using dry cloth and straighten the conductors by hand.

Note:

Do not use nose pliers/tweezers to straighten conductors as this may deform conductors diameter.

Dust and other particles on the conductor, bends and kinks in the conductor give wrong measurement of the diameter / gauge number.

2 Pick a labelled single strand wire for measurement of gauge number.

3 Hold the SWG in one hand and insert the exposed conductor of the wire into one of the large holes of the stranded wire gauge (SWG) and take out the wire through the upper slot above that hole as shown in Fig 2.

4 Repeat step 3 till the conductor exactly fits into the slot as shown in Fig 3. Remove the conductor by pushing it down into the hole and pulling it out.

5 Note down the number printed / marked at the hole and record the observation in Table 1.

6 Repeat steps 3 and 4 for the other end of the wire.

7 Repeat steps 3 to 6 for the other single strand wires.

8 Get the work checked by the Instructor.

Fig 2

18 SWG
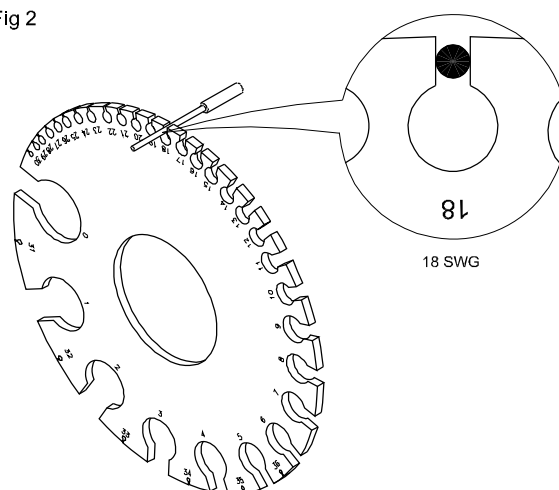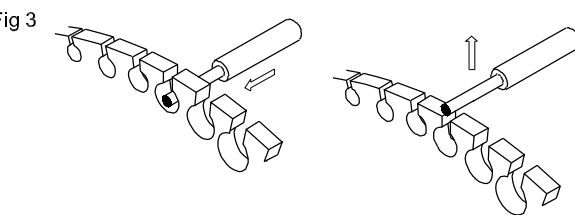
Fig 3

9 Take the rigid multistrand wire. Clean the conductors and untwist the twisted strands and separate one of the strands as shown in Fig 4.

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Fig 4
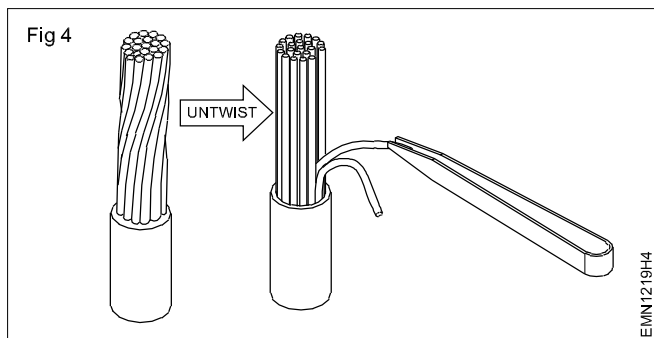
10 Carry out steps 3 & 4 measure and record the SWG of one strand of the wire.

11 Count the total number of strands available in that wire and record it in Table 1

12 Repeat steps 9 to 11 for the flexible multistrand wires.

13 Refer pocket table book/wire table and convert the measured SWG value of wires into diameter of the wires in inches and millimeters. Record the readings in Table 1.

Table 1

	WireTag No.		Conductor Size of SWG	Conductor dia. in mm	Conductor dia.in inches	No. of Conductors
Single Strand Wire	Sample Entry	END 1	20	0.91	0.036	1
		END-2	20	0.91	0.036	
	1	END-1				
		END-2				
	2	END-1				
		END-2				
Multi-strand Wire	3					
	4					
	5					
	6					
	7					
	8					

14 Get the work checked by the Instructor.

— — — — — — — —

TASK 2 : **Measurement of diameter of the wire using Outside Micrometer**

Note: The Instructor has to guide the trainees in handling the micrometer and taking precise measurements.

1 Find the least count and zero error of the given micrometer as shown in Fig 5. Note down the values in Table 2.

2 Take the wire with label No. 1 for measurement. Clean and straighten the exposed conductor.

3 Carefully hold the micrometer in hand and place the conductor in the gap between the anvil and spindle. Turn the thimble till the conductor is just held between the anvil and the spindle as shown in Fig 5. Turn the ratchet till a click sound is heard.

Safety precaution:

Do not over tighten as this may deform the conductor and hence give wrong measurement.

4 Record the reading on the barrel and thimble in table 2. Loosen the grip on the conductor and take out the conductor from the micrometer.

5 Repeat steps 2,3 & 4 for the remaining single strand and multi-strand wires

Measure the diameter of only one strand in the case of multi-strand wires.

6 Calculate and record the diameter of the wires in mm for the micrometer readings recorded.

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.2.19

7 Compare the dia. of the wires noted in Table 1 using stranded wire gauge and the dia. measured using micrometer. If readings are found not matching consult the instructor.

8 Get the work checked by the Instructor.

Note: Keep the wires to be utilized for the next exercise.

Fig 5
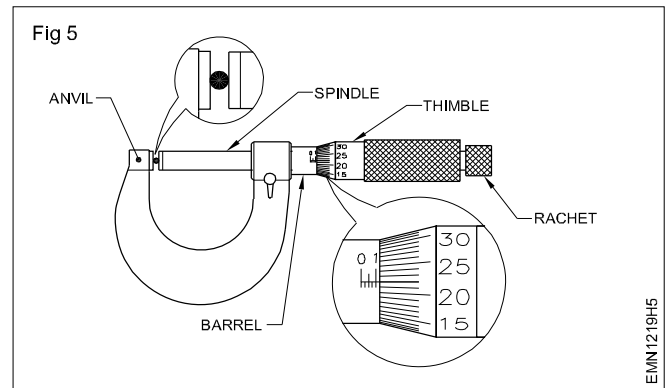
Table 2

Least count (LC)			
Zero error correction (ZC)			
Wire tag No.	**Barrel reading**	**Thimble reading (Thimble div x LC)**	**Wire dia. in mm (2) + (3) ± ZC**
1			
2			
3			
4			
5			
6			
7			
8			
9			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

— — — — — — — —

Refer table and find current carrying capacity of wires

Objectives: At the end of this exercise you shall be able to
- **determine the current carrying capacity of copper conductor by referring to the wire table**
- **determine the current carrying capacity of aluminium conductor by referring table.**

Requirements	
Materials / Components	SWG size in inches/mm
	Wire table of carrying capacity of
• Cotton cloth - as reqd	insulated copper wire table 4 & 5
• Different size of copper conductor cable - as reqd	
• Different size of aluminium conductor cable - as reqd	
• wire table - as reqd	

PROCEDURE

TASK 1 : **Determination of current carrying capacity of copper conductor**

Assumption: A bunch of different diameters of copper conductors are to be displayed on the work bench. Trainees are required to find out the current carrying capacity of wires given below by referring the Table 1.

1 Determine the current carrying capacity of the given copper conductor and note down in Table 2.

Table 1

COPPER AND EQUIVALENT ALUMINIUM CONDUCTOR CABLES CURRENT RATINGS

Copper Conductor				Aluminium Conductor			
Size of cable		Current Rating in amperes		Size of cable		Current Rating in Amperes	
No & dia of wire(mm)	Nominal area in mm²	2-core Cable	3 or 4 core cable	No & dia in mm	Nominal area in mm²	2-core Cable	3 or 4 Core cable

Table 2

Size of cable of Copper Conductor		Current Rating in amperes
No and dia of wire in mm	Normal area in mm²	

2 Determine the copper conductor size for the given
   current rating and note down in Table 3.

Table 3

Current rating in Amperes	Copper Conductor size

3 Get the work checked by the Instructor.

— — — — — — — —

TASK 2 : **Determination of the current carrying capacity of Aluminium conductor**

1 Determine the current carrying capacity of the given
   aluminium conductor and note down in Table 4.

Table 4

Size of cable of Aluminium Conductor		Current Rating in amperes
No and dia of wire in mm	Normal area in mm²	

2 Determine the aluminium conductor size for the
   given current and note down in Table 5.

Table 5

Current rating in Amperes	Aluminium Conductor size

3 Get the work checked by the Instructor.

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Crimp the lugs to wire end

Objectives : At the end of this exercise you shall be able to
- **choose the wire**
- **collect the suitable size of lug**
- **crimping the lug.**

Requirements			
Tools/Instruments/Equipments		**Materials/Components**	
• Crimping pliers (1mm to 16mm)	- 1 No	• Lugs 1.5 mm	- 6 Nos
• Steel rule 300mm	- 1 No	• Lugs 2.5 mm	- 6 Nos
• Insulated side cutting pliers	- 1 No	• Lugs 4 mm	- 6 Nos
• Electrician Knife	- 1 No	• Lugs 6 mm	- 6 Nos
• Wire stripper auto-eject 200mm	- 1 No	• Cable 1.5 sq mm,2,4,5,6 length	
• Wire stripper (manual) 200 mm	- 1 No	300mm	- 1 No each
		• Cotton waste	- as reqd
		• Conducting paste	- 1 tube

PROCEDURE

TASK 1 : **Choosing the wire**

1 Select the wire depending on the application of work.

2 Cut the wire 300 mm length from the wire coil as shown in Fig 1.

3 Get the work checked by the Instructor.

Fig 1

— — — — — — — — —

TASK 2 : **Collecting the suitable size of Lug**

1 After finding the cable size, select the correct lug from the table as shown in Fig 2.

2 Show it to the instructor for its correctness.

3 Get the work checked by the Instructor.

Fig 2

— — — — — — — — —
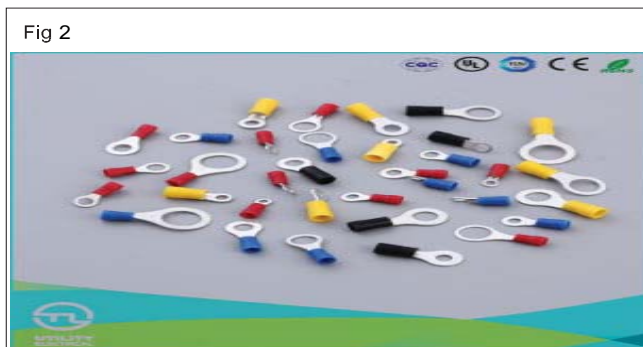
TASK 3: **Crimping the lug**

1 After selecting wire and lug select the correct crimping tool

2 Measure the length of Lug using steel rule.

3 Measure appropriate strip length. Line up the connector barrel to the wire and mark the cable as shown in Fig 3.

4 Once determined the length of the wire strip the end using wire stripper, being careful not to damage the conductors as shown in Fig 4.

5 Check the striped insulation to the proper length, so that the conductor can be fully inserted into the connector barrel as shown in Fig 5.

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Fig 3

Fig 4
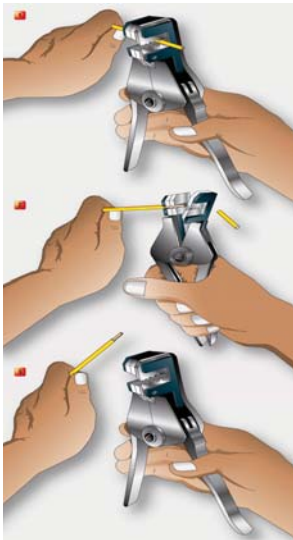
Fig 5

6   Insert the wire in to the lug as shown in the Fig 6.

Fig 6

7   Ensure that all wires of the conductor are within the crimp barrel as shown in Fig 7.

Fig 7

8   Select the appropriate die style to match the installation tool. The die index number and colour code indicated on the connector should match when the correct die is chosen as shown in Fig 8.

Fig 8

9   Start the crimping tool cycle and hold steady until the entire cycle is complete. Release ram. Repeat the same process until all crimp locations on the barrel have been completed as shown in Fig 9.

Fig 9

10 After crimping remove the crimped cable as shown in Fig 10.

Fig 10
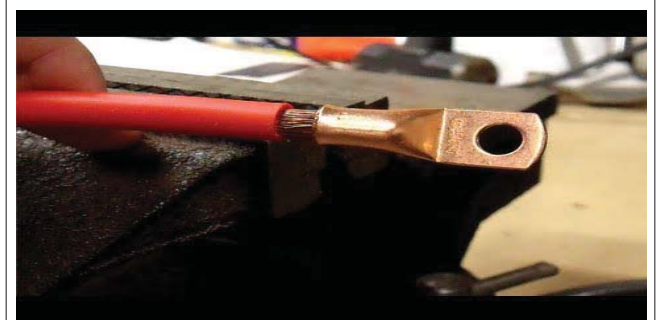
11 Get the work checked by the Instructor.

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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.2.21   **33**

Measure AC and DC voltages using multimeter

Objectives: At the end of this exercise you shall be able to
- **measure the AC voltage using multimeter**
- **measure the DC voltage using multimeter.**

Requirements

Tools/Instruments/Equipments

- Digital Multimeter with probes - 1 No
- Auto transformer (VARIAC) single phase - 1 No
  having input 0-220V AC output 0-270VAC
  /15A

Materials/Components

- Dry cell 1.5 V / AA size - 1 No
- 3V CR 2032 Lithium - 1 No
- 9V battery (Alkaline type) - 1 No
- 12 V battery (SMF type) AH rating available - 1 No
  in the section)

Note:

1 The instructor has to explain the differences between the analog multimeter and DMM.

2 Provide an analog multimeter to trainees and instruct them to study the panel/ranges/ scales/selector switch/socket etc., in it.

PROCEDURE

TASK 1: **Measurement of AC voltage using multimeter.**

1 Observe and check the number of available ranges in the given multimeter.

2 Plug the black colour probe into the COM socket and plug the red colour probe into the V, Ω, mA, socket of multimeter as shown in Fig 1.

Fig 1

3 Select the multimeter knob (switch) to the AC Voltage range.

Note : Most multimeters power up in Auto range mode. This automatically selects a measurement range based on voltage present.

4 Connect the meter across the autotransformer output socket.

Safety precaution:

Note: Before power ON auto transformer keep the voltage selector knob in 0V, position.

5 Power ON the Auto Transformer observing the multimeter increase the voltage to 10 volt.

6 Record the observation in Table - 1

7 Repeat the above step in steps of 10V up to 50V note down the corresponding readings in Table 1.

8 Get the work checked by the instructor

9 Bring down the voltage selector to OV position and switch OFF the variac.

Table - 1

S.No	Variac dial position	Meter reading	Remarks
1			
2			
3			
4			
5			

— — — — — — — —

TASK 2 : **Measurement of DC voltage using multimeter**

1 Select the multimeter knob (switch) to the DCV or $\underset{\cdots}{\underline{V}}$ Voltage section as shown in Fig 2.

Fig 2

2 Take the 9V battery identify supply terminals place the red probe on the positive terminal, and the black probe on the negative terminal.

Note: If the range was set too high, may not get a very accurate reading. Turn the dial to a lower range to get a better reading as shown in Fig 3.

Fig 3

3 With the range set correctly, as shown in Fig 3, measure the voltage of the battery and record the readings in Table - 2.

4 Repeat the above steps for other battery and record the reading in Table - 2.

Table 2

S No.	Battery type	Mark readings	Remarks
1	1.5 V		
2	3 V		
3	9 V		
4	12 V		

5 Get the work checked by the Instructor.

— — — — — — — —

Identify the type of meters by dial and scale marking / symbols

Objectives: At the end of this exercise you shall be able to
- **identify the type of meter (AC/DC) and function from the dial markings**
- **identify the type of meter (AC/DC) from the symbols on the dial.**

Requirements

Tools/Instruments/Equipments

- Voltmeter 0 - 250 V, DC, MC panel type   - 1 No
- Voltmeter 0 - 500V, MI panel type   - 1 No
- Ammeter 0 - 5A, DC, MC panel type   - 1 No
- Ohmmeter 0 - 2 MΩ   - 1 No
- Multimeter - analog type with probes   - 1 No
- Multi-range voltmeter MC/MI   - 1 No

Aids: Chart showing different dial scale markings (Linear and non linear) and symbols used on AC/DC and DC meters.

Materials / Components

- Connecting leads flexible   - assorted sizes

Note: The Instructor has to label the meters used for this exercise before issuing to trainees.

PROCEDURE

TASK 1:- **Identification of meter type (AC/DC) and its function from the dial markings.**

1 Pick one of the labelled meter from the lot, observe the markings on the dial scale calibration. Refer to the chart and record the observation in Table 1.

2 Observe the symbols printed at the bottom line on the dial plate and record the observations in Table 2. with reference to the chart.

Table 1

Label	Dial scale divisions markings		Function letter	Type of meter
No of Meter	Linearly Yes/ No	Non - Linearly Yes/ No	V/mA / Ω	AC/ DC or DC only
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

3 Identify the instruments shown in Figures 1 & 2 for their types - DC, AC or both, with reference to Fig 3 Record the response in the Table 2.

4 Identify the instruments single or multi-scale / multi-range instruments and their functions. Record the response in Table 3.

Fig 1

Fig 4

Fig 2

Fig 5
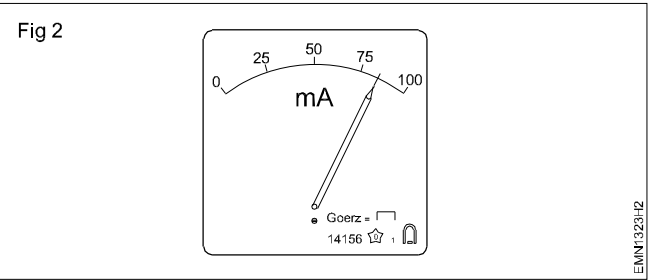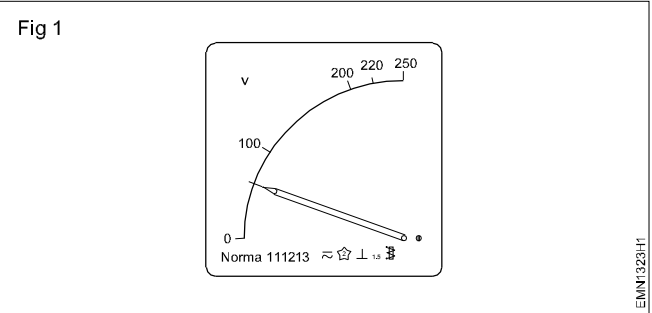
TABLE 2

Instrument	Symbol	Function
Figure 1		
Figure 2		
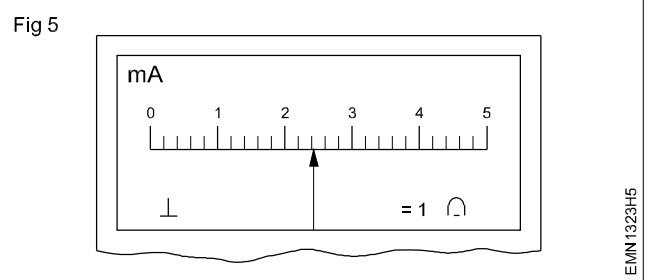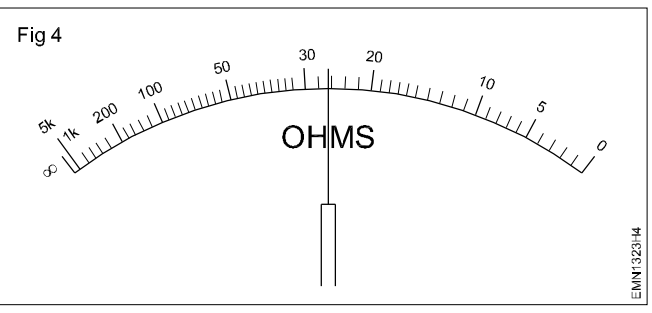
TABLE 3

Instrument	Range	Scale	Function
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Fig 3

⌓	MOVING COIL MEASURING ELEMENT
⌓	MOVING COIL MEASURING ELEMENT WITH RECTIFIER
⊠	MOVING IRON MEASURING ELEMENT
—	TYPE OF CURRENT: ONLY DIRECT CURRENT
∼	TYPE OF CURRENT: ONLY ALTERNATING CURRENT
≈	DIRECT AND ALTERNATING CURRENT
⊥	POSITION FOR USE: VERTICAL
▭	POSITION FOR USE: HORIZONTAL
1	INDICATION ERROR ±1%
2.5	INDICATION ERROR ±2.5%
3.5	INDICATION ERROR ±3.5%
☆2	TEST VOLTAGE: 2KV=2000V
⚠	OBSERVE INSTRUCTIONS FOR USE

SYMBOL FOR CHARACTERISING ELECTRICAL MEASURING INSTRUMENTS

5 Get the work checked by the Instructor.

— — — — — — — —

Demonstrate various analog measuring instruments

Objectives: At the end of this exercise you shall be able to
• **select various analog measuring instruments**
• **demonstrate various analog measuring instruments.**

Requirements			
Tools/Equipments		**Materials/Components**	
• MC Ammeter 0-5A	- 1 No	• Cotton Waste	-as reqd
• MI Ammeter 0-10A	- 1 No		
• MC Milli ammeter 0-1mA	- 1 No		
• MC Milli volt meter 0 - 100mV	- 1 No		
• MC voltmeter 0-50V	- 1 No		
• MI Voltmeter 0-500 V	- 1 No		
• Mega ohmmeter 0-10 Mega ohm	- 1 No		

PROCEDURE

TASK 1 : **Demonstration of various analog measuring instruments.**

1 **The Instructor has to arrange a set of moving coil / moving iron type analog measuring instruments such as Ammeters, voltmeters, milliammeters, milli voltmeters, etc and demonstrate them to trainees.**

2 **Label each meter type separately and group them under MC / MI**

1 Pick one of the labelled meter, observe the panel and record the observations in Table - 1

2 Repeat the above step for all the labelled meters.

Table 1

Label No. (1)	Name of the Meter (2)	Measuring Range (3)	Diagram of dial scale marking (4)
1	MC ammeter		
2	MC Milli Voltmeter		
3	Mega Ohmmeter		
4	MI Volmeter		
5	MC Milli ammeter		
6	MI Ammeter		
7	MC Voltmeter		
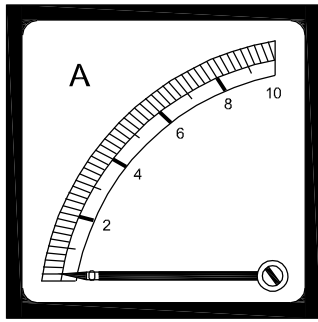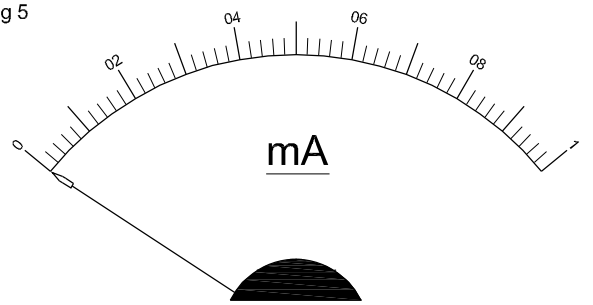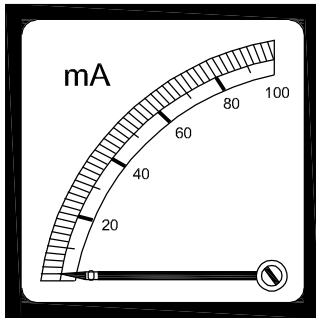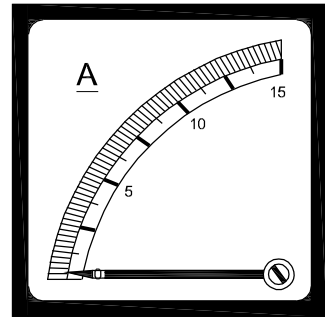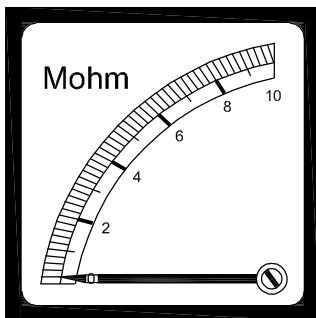
38

Fig 1

A

10
8
6
4
2

EMN1324H1

Fig 5

mA

02 04 06 08
0 1

EMN1324H5

Fig 2

mA

100
80
60
40
20

EMN1324H2

Fig 6

A

15
10
5

EMN1324H6

Fig 3

Mohm

10
8
6
4
2

EMN1324H3

Fig 7

V

50
40
30
20
10

EMN1324H7

3   Get the work checked by the Instructor.

Fig 4

V

1000
800
600
400
200

EMN1324H4

— — — — — — — —
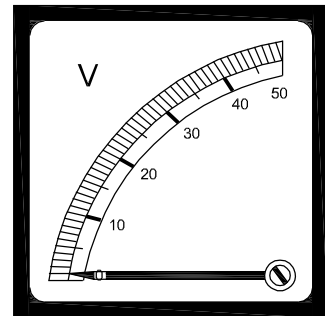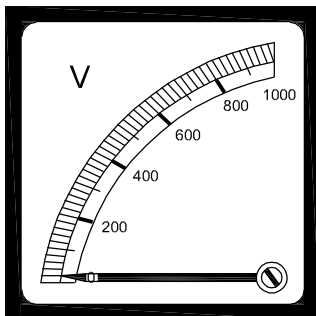
Find the minimum and maximum measurable range of the meter

Objectives: At the end of this exercise you shall be able to
• **determine the minimum and maximum measurable range of the meter.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• MC ammeter 0-500 mA	- 1 No
• MC voltmeter 0-10V	- 1 No

Materials/Components

• Connecting cable copper 1.5sq.mm	- as reqd
• Cotton cloth	- as reqd
• Variable resistor/Rheostat 0-1kΩ	- 2 Nos
• SP Switch 6A, 240V	- 1 No
• 9V Battery	- 1 No

PROCEDURE

1 Collect ammeter, voltmeter, variable resistance battery and SP switch.

2 Assemble the circuit as shown in Fig 1.

Fig 1

3 Set the variable resistance to have zero out.

4 Close the switch 'S'.

5 Note down the minimum measurable range of milliammeter and voltmeter and record in the Table 1.

6 Gradually increase load to 500 mA by varying variable resistance.

7 Also adjust the voltage across load resistor to 10 volts.

8 Note down the maximum measurable range of milliammeter and voltmeter and record it in Table 1.
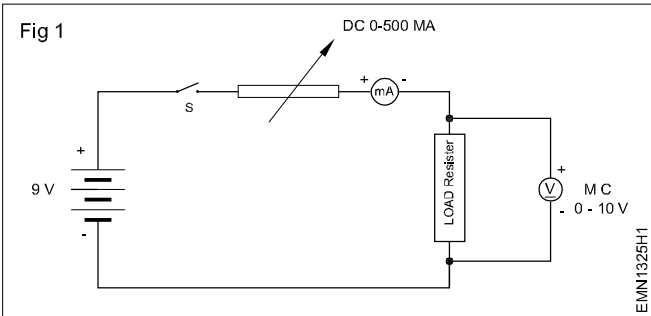
Table -1

1 Minimum range of milli ammeter _____
2 Minimum range of volt meter _____
3 Maximum range of milliammeter_____
4 Maximum range of voltmeter _____

9 Get the work checked by the Instructor.

— — — — — — — —

Carryout mechanical zero setting of a meter

Objectives: At the end of this exercise you shall be able to
• **carry out mechanical zero setting of an analog meter**
• **measure the voltage of a dry cell using a single range voltmeter.**

Requirements

Tools/Equipments/Instruments

• MC Voltmeter 0-5V or 0-50V	- 1 No
• MC Voltmeter 0-15V	- 1 No
• Screw driver 150mm with 3mm blade	- 1 No

Materials / Components

• Dry cells of different voltage range	- as reqd
• Lead acid battery 12V/60 AH	- 1 No

Note:The instructor has to label the meter before issuing them to trainees.

PROCEDURE

TASK 1 : **Carry out Mechanical zero setting of a meter**

1 Take one of the labelled MC Voltmeter and check whether the meter needle moves freely on the graduated scale.

If the needle is not moving freely consult your instructor.

2 Place the meter on the table horizontally and check whether the needle is pointing exactly on the zero position on the meter scale as shown in Fig 1a.

If the pointer is exactly on the zero marking of he scale, the mechanical zero setting of the meter is proper.

3 If the pointer is not pointing exactly on the zero marking as in Fig 1(b) & (C) the meter has the Mechanical Zero error.
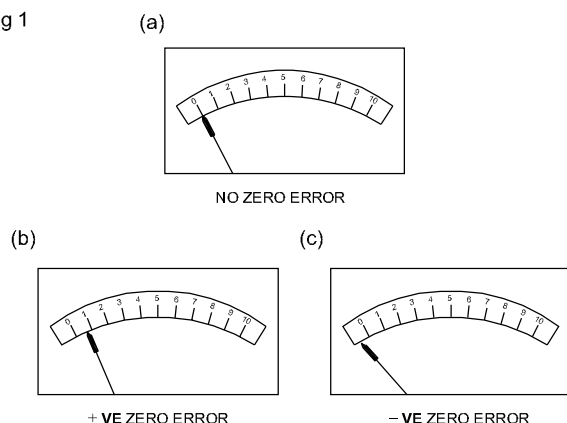
4 Record your observation in Table 1.

5 Repeat the steps 1 to 4 for the other meter also.

6 Permission to correct the error on the meter.

7 Put the screw driver on the mechanical zero adjust the screw as shown in Fig 2.

8 Observing the pointer, turn the screw very slowly as required till the pointer reaches exactly on the 'O' marking on the scale.

Fig 2

ZERO ADJUST SCREW

EMN1326H2

9 Get the work checked by the Instructor.

Fig 1

(a)

NO ZERO ERROR

(b)

+ **VE** ZERO ERROR

(c)

− **VE** ZERO ERROR

EMN1326H1
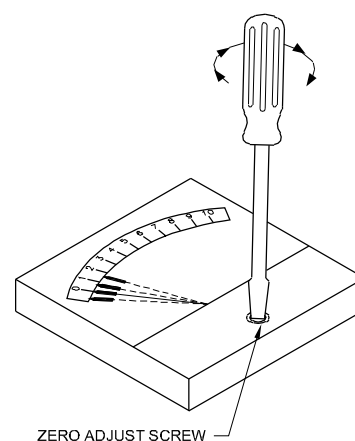
Table 1

Label No.	Meter range	Pointer Position on the dial scale	Positive/ Negative error	Direction of screw driver rotation needed clock-wise/counter clock wise	Avoid parallax error
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

— — — — — — — —

TASK 2 : **Measurement of the voltage of dry cell & lead acid battery using single range voltmeter.**

1 Take any one of dry cell from the given lot Clean its terminals using cloth.

2 Identify the +ve and -ve terminals of the cell.

3 Touch the -ve meter probe (Black) to the -ve terminal of the cell as shown in Fig 3.

4 Also touch the +ve probe (Red) to the +ve terminal of the cell as shown in Fig 3.

> **If the pointer deflects reverse direction on the scale the identified cell polarity is wrong. Recheck and interchange connection.**

5 Note down the voltmeter reading.

6 Repeat the steps for the remaining cells and lead acid battery and note down the voltmeter reading.

7 Get the work checked by the Instructor.

Fig 3

— — — — — — — —
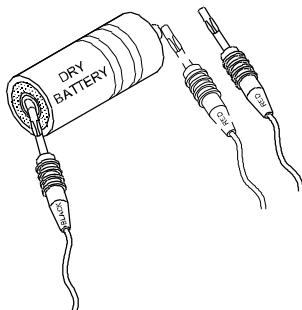
Check the continuity of wires, meter probes and fuse etc

Objectives: At the end of this exercise you shall be able to
• **check the continuity of a 1.5 sqmm PVC wire**
• **check the continuity of multimeter probes**
• **check the continuity of a glass cartridge fuse.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Digital Multimeter with probes	- 1 No
• Continuity tester	- 1 No
• Wire stripper	- 1 No
• Battery pack/Lead acid Battery 6V/5AH	- 1 No

Materials/Components

• Miniature lamp holder with 12V	- 1 No
• PVC wire 2.5 sq.mm	- 1 m
• PVC wire 1.5 sq.mm	- 1 m
• Multimeter Probes	- 1 Pair
• Glass cartridge fuse assorted ratings/sizes	- 3 Nos

> **The instructor has to provide assorted wires of any length for continuity checking. Different size and rated glass cartridge fuses both serviceable and unserviceable ones for this task.**

PROCEDURE

TASK 1 : **Checking the Continuity of meter probes**

1   Set the range selector switch to continuity/buzzer position on the DMM.

2   Insert both the test probes into the COM and VΩmA sockets following colour codes.

3   Touch both the open ends of test probes and observe for the zero Ohm on the display and listen to the buzzer sound.

4   Record your observations in Table - 1 to ensure the continuity of the meter probes.

5   Get the work checked by the Instructor.

Table 1

Sl.No.	Name of the Item	Display on meter	Buzzer sound	
			Yes	**No**
1	Meter test probes			
2	Wire - 1			
3	Wire - 2			
4	Fuse - 1, Fuse-2			

— — — — — — — — —

TASK 2 : **Checking the Continuity of wires**

1   Select two assorted wires of any length.

2   Mark 10mm and skin the insulation at both ends of the wires using wire stripper as shown in Fig 1.

Fig 1

3   Ensure that the DMM is set to continuity/buzzer position.

4   Connect both skinned ends of the wire across the open ends of test probes and observe for buzzer sound and zero display on the meter.

5   Record the observations in Table - 1.

6   Repeat steps 2 to 5 for the other wire also.

7   Get the work checked by the Instructor.

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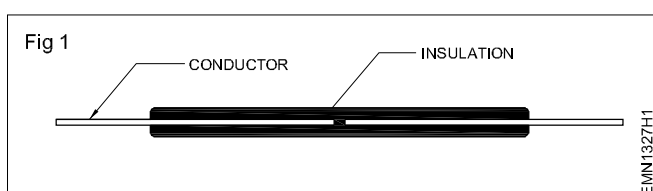
TASK 3 : **Checking the Continuity of fuse**

1   Ensure that the DMM is set to continuity/buzzer position.

2   Pick and connect the glass cartridge fuse across the open ends of test probes as shown in Fig 2.

3   Observe the display; listen to the buzzer sound and record the observations in Table 2

> **If the reading is between 0 and 5 ohms the fuse is good. A higher reading indicates a bad or degraded fuse. A reading of OL (over limit or infinity) definitely means a blown fuse wire.**

4   Repeat above steps for all the fuses and record observations in Table.

Fig 2
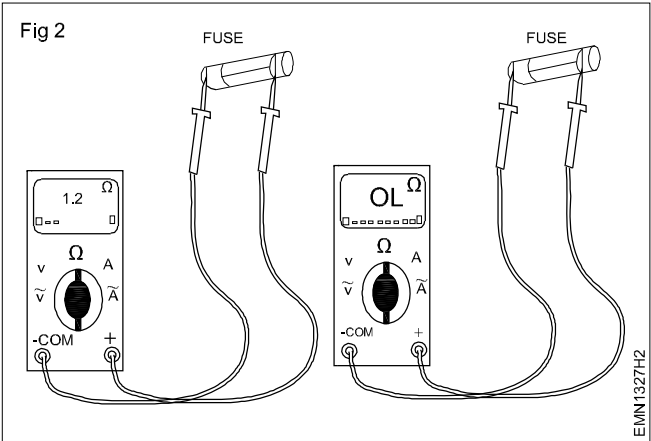
5   Get the work checked by the Instructor.

Table 2

Sl.No.	Fuse reading in ohm	Fuse name/type	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
12			
13			
14			
15			
16			
17			
18			
19			
20			

— — — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.3.27

Measure voltage and current using clamp meter

Objectives: At the end of this exercise you shall be able to
• **measure AC voltage using clamp meter**
• **measure DC voltage using clamp meter**
• **measure AC current using clamp meter**
• **measure DC current using clamp meter.**

Requirements

Tools/Equipments/Instruments

• Clamp meter with built in multimeter	- 1 No
• Clamp meter (Digital) voltage, current measurement	- 1 No
• Variac 0-270VAC	- 1 No
• Regulated power supply 0-30V/2A	- 1 No

Materials/Components

• 12V/10W bulb with holder and wire	- 1 Set
• 100W/240V Test lamp with wire	- 1 No
• Lead acid battery 12V / 7AH	- 1 No
• SPST switch	- 1 No

PROCEDURE

TASK 1 : **Identification of ranges and display on Digital Clamp meter**

1 Refer to the user manual of the Digital clamp meter.

2 Switch ON the clamp meter and observe the display, identify each icon representing various parameters measured by the clamp meter.

3 Note down each one of them, with reference to user manual record details in the Table 1.

Table 1

Sl. No	Description of the display/icon	Meaning/ function	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

TASK 2 : **Measurement of AC voltage with Clamp meter**

1 Connect the black test of probe into the COM terminal/ socket.

2 Plug the red probe into the VΩmA socket.

3 Turn the rotary function switch to ACV/ voltage section as shown in Fig 1.

Note: For auto ranging model it automatically display the measured value for other models.

4 Turn on the Clamp meter.

5 Measure the voltage by touching the probes to the AC wall socket of the circuit as shown in Fig 2.

Fig 1

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Fig 2
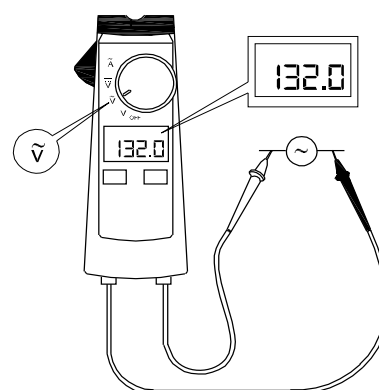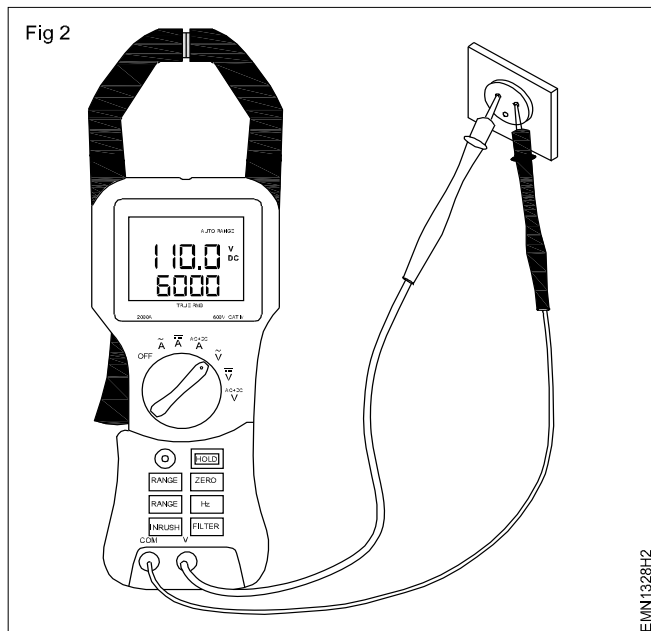
6 View the reading on the display and note down voltage in Table 2.

7 Repeat step 5 for other test point across variac and note down the voltage in Table 2.

8 Get the work checked by the Instructor.

Table 2

Sl. No	Quantity Measured	Volt AC/DC	Remarks
1	Wall socket		
2	Variac		
3	Lead Acid Battery		
4	Regulated DC power supply		

— — — — — — — — —

TASK 3 : **Measurement of DC voltage using Clamp meter**

1 Follow the Steps 1 and 2 of task 2.

2 Turn the rotary function switch of the clamp meter to DCV voltage section as shown in Fig 3.

Fig 3
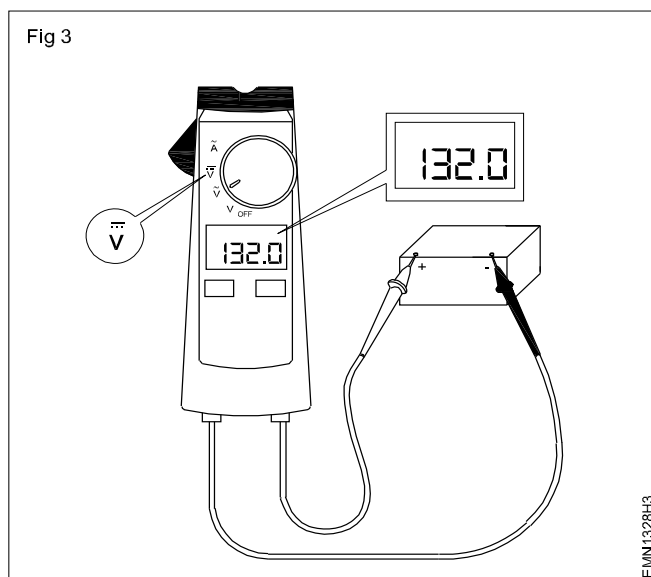
3 Turn on the Clamp meter.

4 Measure the DC voltage by touching the probes across the terminals of battery as shown in Fig 4.

5 Observe the reading on the display and note down in Table 2.

Fig 4
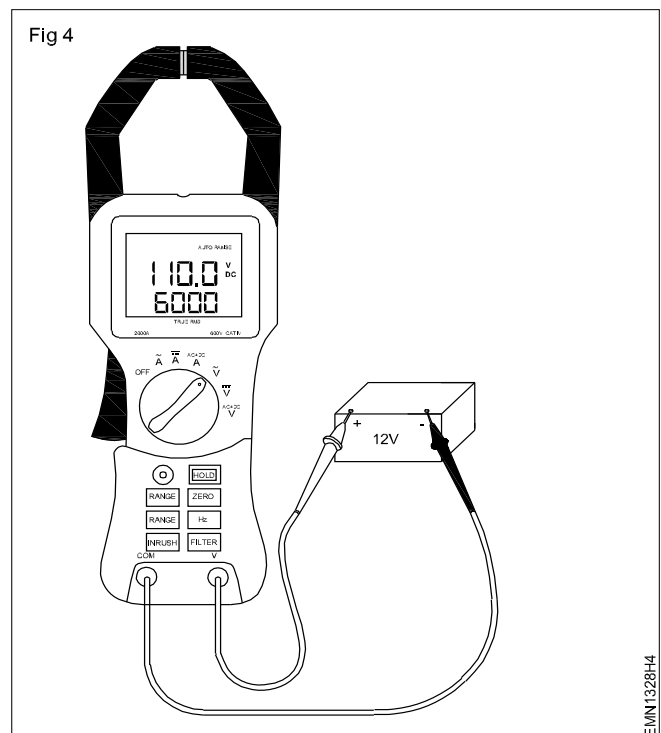
6 Repeat the DC voltage across the regulated power supply and record the observation in Table 2.

7 Get the work checked by the Instructor.

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TASK 4 : **Measurement of AC current using Clamp meter**

1 Turn the rotary function switch to of the clamp meter ACA current section as shown in Fig 5.

Fig 5
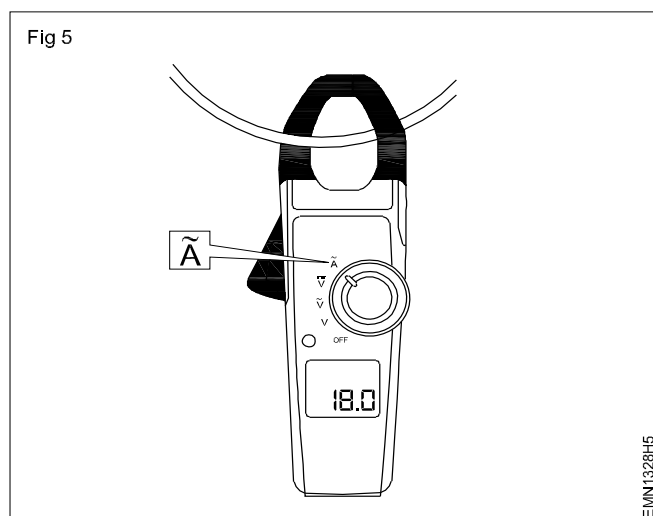
2 Select the circuit current to be measured in AC load and determine the approximately nearest current range on the meter.

> **The clamp meter will automatically measure the current by the auto ranging model.**

3 Identify the Phase conductor cable and separate it from the Neutral and Earth cables.

TASK 5: **Measurement of DC current using Clamp meter**

1 Connect the 12V/10W lamp across the 12V lead acid battery as shown in Fig 7.

2 Turn the rotary function switch to DC A Current section as shown in Fig 7.

Fig 7
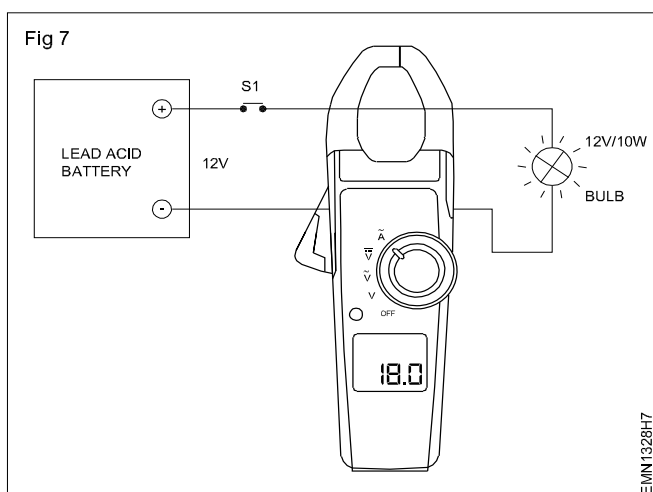
3 Switch ON the 12V DC power supply and ensure the lamp is glowing.

4 Repeat steps 4 and 5 of task 4 above and record the readings in Table 3.

5 Repeat the steps with the lamp connected across the DC power supply with 10V.

6 Switch ON the 10V DC supply measure the DC current and record the readings in Table 3.

4 Open the jaws of clamp meter by pressing the jaw keep the phase conductor inside and release as shown in Fig 6.

Fig 6

5 Observe the current reading displayed on the meter and record the readings in Table 3.

6 Connect the 100W test lamp to AC mains, and switch ON the circuit.

7 Repeat steps 4 and 5, record readings.

8 Get the work checked by the Instructor.

Table 3

Sl. No	Current measured circuit/point	Current AC/DC	Remarks
1	AC load circuit	A.AC	
2	Test lamp 100W	A.AC	
3	Battery circuit	A.DC	
4	DC power supply circuit	A.DC	

Fig 8
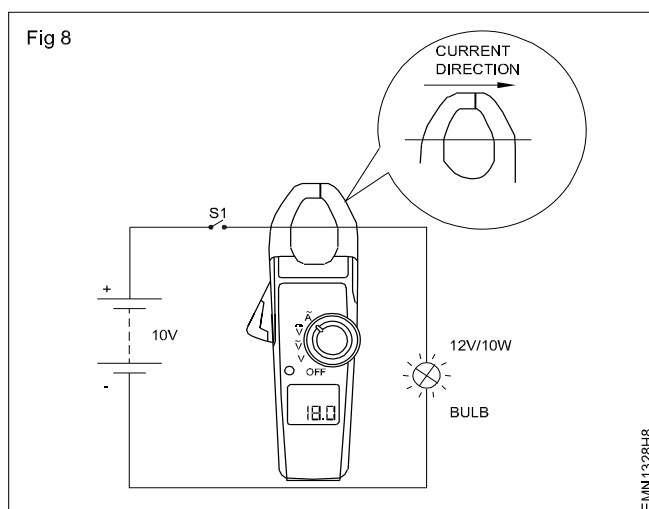
7 Get the work checked by the Instructor.

Identify the +ve and -ve terminals of the battery

Objectives: At the end of this exercise you shall be able to
• **determine the polarity of a battery using a digital voltmeter and analog voltmeter.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Voltmeter 0-15V MC	- 1 No
• Voltmeter 0-300 MC	- 1 No
• Digital multimeter with probes	- 1 No
• Lead acid Battery 12V/7AH	- 1 No

Materials/Components

• Connecting leads flexible	- as reqd
• Test probes	- 2 Nos

Note: The instructor has to provide a fully charged lead acid battery with specification details clearly in the name plate.

PROCEDURE

1 Collect the lead-acid battery, observe the construction, supply terminals and specifications/details printed.

2 Draw the free hand sketch and mark the supply polarities in it.

3 Record the technical details like nominal voltage, current capacity, charging current, discharging rate etch in Table 1.

4 Select DC volt measuring range (preferably higher range) in DMM, insert the black colour test probe into the COM socket and red colour test probe into the V, Ω, mA marked socket.

5 Touch both the test probes across the lead-acid battery terminals and observe the meter display Mark the polarity of the battery as that of the voltmeter; the +ve terminal of voltmeter as +ve terminal and the -ve terminal of voltmeter that touches the battery terminal as -ve terminal of the battery.

Note: If the deflection is reverse and the pointer kicks backward, do not try again.

6 Observe the polarity displayed and bring the voltage measuring range down/nearer to the battery voltage printed/marked.

7 Record the readings in Table and confirm the correct polarities of battery.

8 Interchange the test probes, repeat the steps 5 to 7 and verify the + or - sign displayed with the digits.

-ve sign indicates that test probes/battery polarities are reversed; on the battery terminal red colour is marked to indicate positive polarity along with a + sign and black colour is marked to indicate negative polarity colour is marked to indicate negative polarity along with a - sign by the side of terminal posts/connecting points.

Note: Analog type volt meter reads the DC voltage of battery with current polarity. The pointer will reverse its deflection for opposite polarities. Do not keep the meter in the reversed polarity longer.

Table 1

			Free hand sketch of battery
1	Model/Make		
2	Nominal volt		
3	Nominal current capacity		
4	Charging current		
5	Discharge rate		
6	DC output measured using DMM		
7	DC output measured using analog voltmeter		
	Effect an analog meter test probes interchanged.		

9 Get the work checked by the Instructor.

— — — — — — — —

Identify the rated output voltage and AH capacity of given battery

Objectives: At the end of this exercise you shall be able to
• **identify the rated output voltage and Ampere hour capacity of given battery.**

Requirements

Tools/Equipments/Instruments

• MC Voltmeter 0-5A   - 1 No
• Digital multimeter with probes   - 1 No

Materials/Components

• Lead acid battery 6V/4.5 AH   **-** 1 No
• Lead acid battery 12V/7AH   - 1 No
• 12V/10W bulb with holder   - 1 No
• Connecting cables   - as reqd
• SPST switch   - 1 No

Note: The instructor has to provide fully charged batteries with specification/details clearly visible and label them for this exercise/task.

PROCEDURE

1 Collect the battery, read and record the name plate details in Table 1.

2 Identify the rated output voltage and record it in the Table -1.

3 Identify the Ampere hour capacity and record it in the Table -1.

Table 1

Name plate details	Label No.1	Label No.2
Manufacturer Name:		
Type:		
Model :		
No. of Cells:		
Rated output voltage:		
AH Capacity:		

4 Connect the lamp in series circuit with ammeter as shown in Fig 1.

5 Switch ON the circuit, observe the lamp is glowing and the ammeter current reading.

6 Record the reading in Table 2

7 Keep the lamp in ON condition for 15 min and record the current flow in Table 2.

Table 2

Sl. No	Terminal voltage	Load Current	After 15 min current
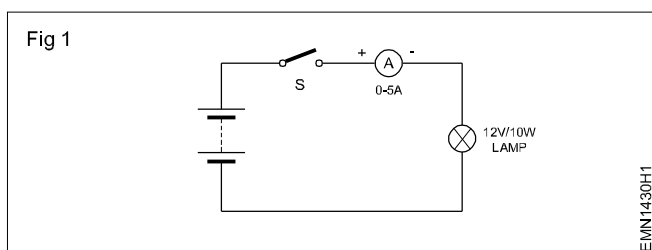
8 Switch OFF the circuit remove the battery and replace the other battery.

9 Repeat steps 5 to 7, record readings.

10 Get the work checked by the Instructor.

Fig 1

S   0-5A   12V/10W LAMP

EMN1430H1

Measure the voltages of the given cells/battery using analog/digital multimeter

Objectives: At the end of this exercise you shall be able to
• **measure the voltage of given cell/battery using analog multimeter**
• **measure the voltage of given cell/battery using digital multimeter.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Digital multimeter with probes **- 1 No** • Analog multimeter with probes - 1 No	• Lead acid battery 6V/12V any AH rating - 1 No • 1.5V/3V/9V battery -1 No each

Note: The instructor has to label the cells and batteries used for this exercise /Task

PROCEDURE

TASK 1 : **Measurement of cell/battery voltage using analog multimeter**

1 Observe the front panel and insert the black colour probe "COM" socket of analog multimeter and insert the red colour probe into the V mA Ω socket as shown in Fig 1.

Fig 1

2 Set the range selector knob of multimeter to DCV, as shown in Fig 2.

Fig 2

3 Set the voltage range nearest to the cell / battery voltage as shown in Fig 3.

Fig 3
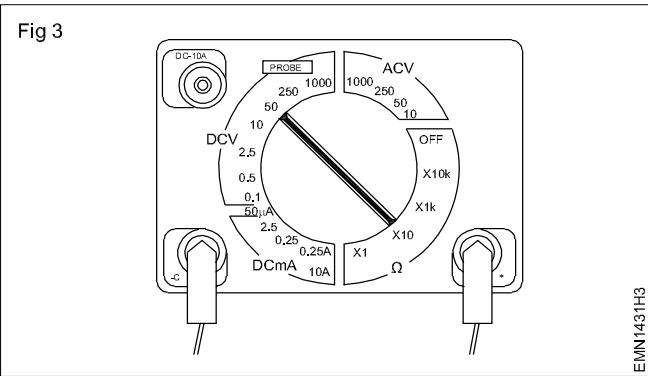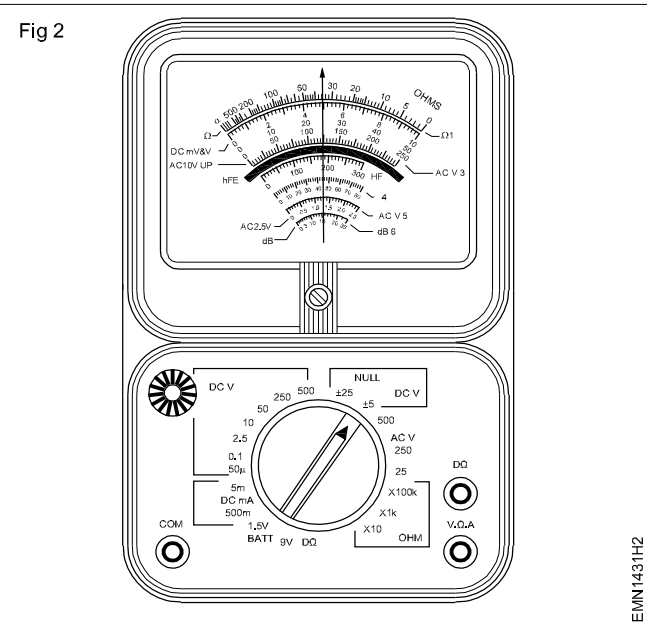
4 Pick the 9V battery, place the black probe on the negative (-) terminal and red probe on the positive (+) terminal of the battery as shown in Fig 4.

Fig 4
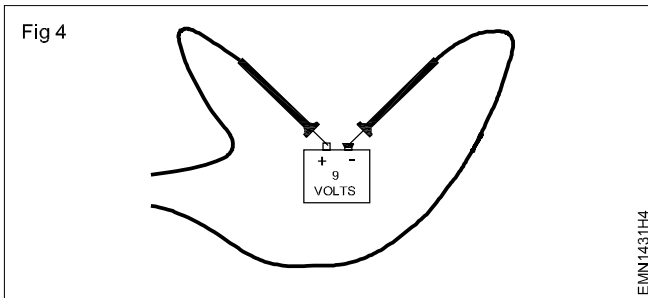
5 Check the Analog voltmeter reading as shown in Fig 5 and record the reading in Table 1.

6 Repeat step 4 and 5 for the remaining labelled cells/ battery.

7 Get the work checked by the Instructor

Fig 5
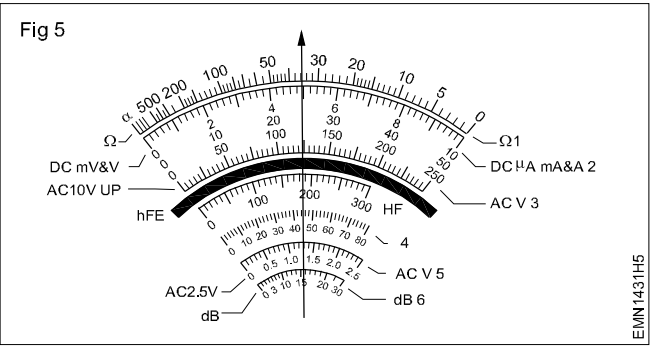
Table 1

Label No	Voltage marked on the cell/ battery	Meter range selected	Measured reading

Note: Readjust the voltage selector knob of the analog meter suitably measure the cell/battery voltage with accuracy of deflection of the pointer on the calibrated scale.

— — — — — — — —

TASK 2 : **Measurement of cell/battery voltage using Digital Multimeter**

1   Plug the black colour probe into the COM socket on the digital multimeter and red colour probe into the V Ω mA socket.

2   Turn the multi meter knob to the DC Voltage selection as shown in Fig 6a and b.

Fig 6a

Fig 6b

Note: Most digital multimeter power up in Auto range mode. This automatically selects a measurement range based on voltage present.

3   Pick one of the labelled battery and measure the terminal voltage as shown in Fig 7a and b.

Fig 7a
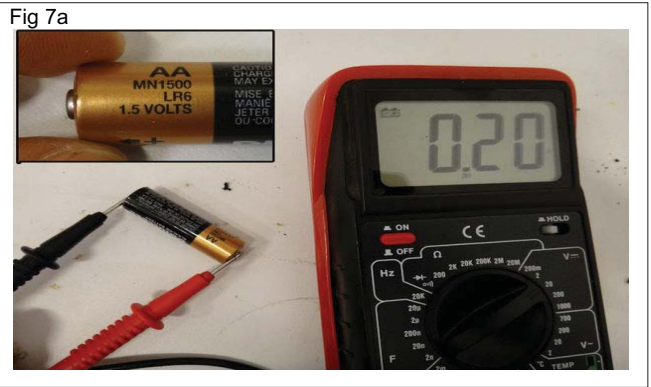
4   Observe the reading displayed on the digital meter and record it in Table 2.

Table 2

Label No	Voltage marked on the cell/ battery	Meter range selected	Measured reading

5   Repeat step 3 and 4 for other labelled batteries also.

Note: For accurate measurement, the voltage range selector of digital meter may be readjusted suitably.

6   Get the work checked by the Instructor.

— — — — — — — — —

Charge and discharge the battery through load resistor

Objectives : At the end of this exercise you shall be able to
• **check the voltage of each cell with a voltmeter in a lead acid battery**
• **check the level and top up electrolyte in lead acid battery**
• **determine the battery condition with a high rate discharge (H R D) tester after one hour charging**
• **check and clean the battery terminals**
• **connect and charge the battery by the constant current method**
• **connect and charge the battery by the constant potential method**
• **discharge the battery through load resistor.**

> **Note: The instructor has to mark the cells with serial numbers suitably.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Voltmeter 0-15V MC	- 1 No
• Ammeter 0-10A MC	- 3 Nos
• Hydrometer	- 1 No
• High rate discharge tester	- 1 No
• 12V Battery charger	- 1 No
• Low voltage DC power supply (0-3V) 10A	- 1 No
• Variable resistor 10 ohms, 5A capacity	- 2 Nos

• Safety goggles	- 1 No
• Lead acid battery 12 volts	- 1 No
• Lamp Bank (240V, 1KVA)	- 1 No
• DPIC 16A	- 1 No

Materials/Components

• Distilled water (450ml)	- 1 Bottle
• Petroleum jelly	- as reqd
• Sandpaper ('Zero' grade)	- as req
• Test leads with crocodile clips	- 1 pair
• Hydrogen peroxide	- as reqd
• Clips	- 1 pair

> **Safety precaution: Wear the goggles to protect eyes from acid or any dust particles.**

PROCEDURE

TASK 1 : **Inspection of the battery electrolyte level**

1 Visually inspect the outside body for any physical damage or bulging; Clean the terminals, if corroded, with sandpaper: if sulphated, clean with wet cotton waste or with soda bicarbonate.

2 Measure voltage across each cell using DC voltmeter and record in Table 1.

> **Do not scrape the battery terminal by any metal strip; it may damage the terminal.**

3 Unscrew and remove all the vent plugs; keep them separately and check the level of electrolyte in all cells.

> **Do not clean the battery top surface keeping the vent plugs open. The accumulated dirt may fall inside the cells and form sediments.**

4 Top up the electrolyte to the marked level in all the cells with distilled water.

5 Insert the Hydrometer rubber nozzle inside the cell, press the bulb, suck electrolyte and release to allow the float to measure specific gravity as shown in Fig 1.
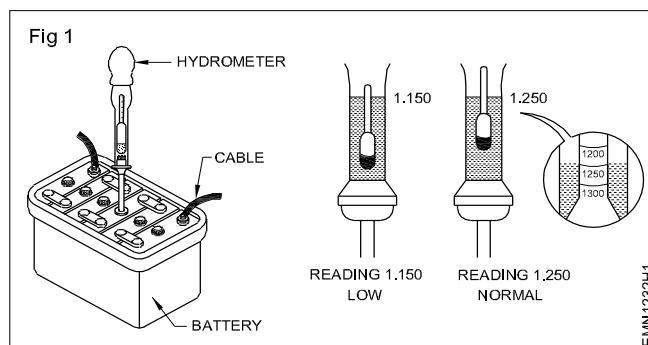
Fig 1

6 Observe and check the initial specific gravity of the electrolyte of each cell using the above step as shown in Fig 1 and record in Table1.

> **Do not use a high rate discharge tester for measuring initial voltage.**

7 Connect the battery charger's +ve lead to the +ve terminal of the battery and the -ve lead of the charger to the -ve terminal of the battery as shown in Fig 2.

8 Adjust the battery charger output voltage equal to or a little higher than the voltage of the battery to be charged.

Fig 2
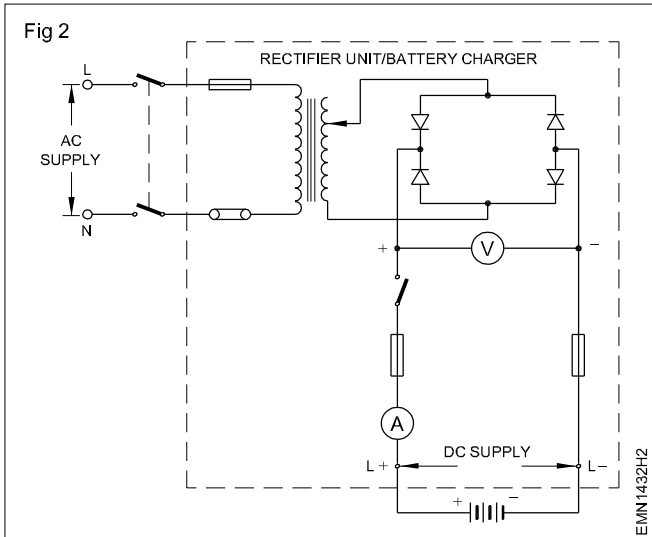
9 Set the charger voltage to produce the determined value of initial charging current and record it in Table 1.

> **Follow the manufacturer's recommendation for current setting for charging as well as discharging.**

10 Observe the voltage of each cell of the battery and specific gravity of the electrolyte at regular intervals (say ONE hour); record the observations in Table 1.

11 Switch OFF the battery charger and disconnect the battery when fully charged; Fit the vent plugs, clean the outer surface with wet cloth and apply petroleum jelly to the terminals.

12 Check the battery for its working voltage under load using a high rate discharge tester for a short period. as shown in Fig 3.

Fig 3

THREE 2 V CELLS CONNECTED IN SERIES HIGH RATE DISCHARGE TESTER CONNECTED ACROSS A CELL
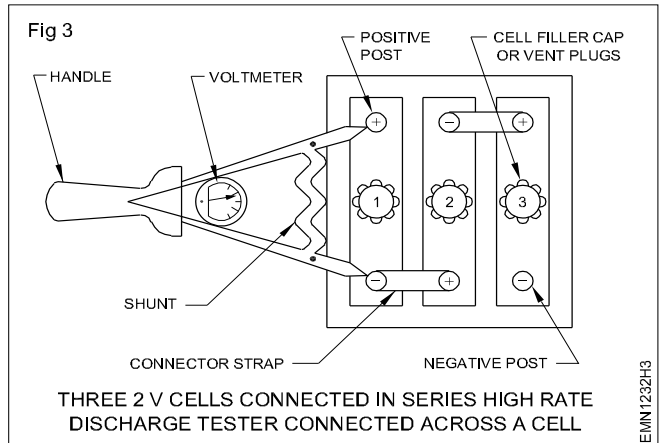
> **Do not keep a high rate discharge tester for a long period, say more than five seconds.**

13 Record the voltage reading shown by the high rate discharge tester= ---------------V.

14 Get the work checked by the Instructor.

Table 1

Cell No.	Initial condition			Charged condition after									
	Voltage	Charging current	Specific Gravity	1 Hr		2 Hr		3 Hrs		4 Hrs		5 Hrs	
				V	SP	V	SP	V	SP	V	SP	V	SP
1													
2													
3													
4													
5													
6													

TASK 2 : **Discharging the battery through load resistor**

1 Check the specific gravity and voltage before discharging.

2 Connect the load resistors to the battery and meter as shown in Fig 4.

Fig 4
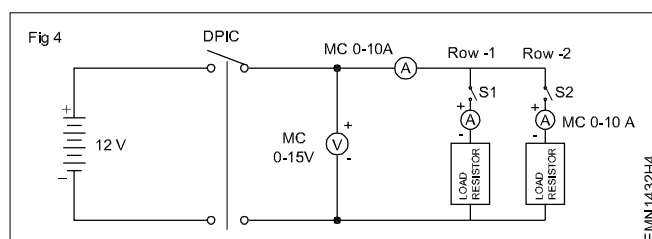
3 Switch ON the circuit for a short time (15 to 30 sec) and observe the ammeter readings.

4 Record the observations in Table - 2.

5 Read and record, the current voltage and specific gravity at regular interval say one hour in Table 2.

> **Do not discharge the battery beyond the minimum value of voltage say 1.75V.**

6 Check the specific gravity and voltage after discharge.

7 Check and compare the differences of specific gravity and voltage before and after discharging the battery.

8 Stop the discharge when the battery reaches below 1.75 volts.

9 After discharge, recharge the battery immediately.

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.4.32   **53**

Table 2

Time after	Load Current I in amps	Changed Condition after Discharge	
		Specific Gravity	Voltage
30 Sec			
60 Sec			
90 Sec			

10 Get the work checked by the Instructor.

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.4.32

Maintain the secondary cells

Objectives : At the end of this exercise you shall be able to
• **check and inspect the battery type, voltage and rating details**
• **clean the battery, test battery condition, electrolyte level and charge the battery.**

Requirements

Tools/Equipments/Instruments

• Trainees tool Kit	- 1 Set
• Hydrometer	- 1 No
• Voltmeter 0-15V DC MC type	- 1 No
• Digital multimeter with probes	- 1 No

Materials/Components

• Lead acid battery 6V/12V 100 AH	- 1 No
• Distilled water 500 ml	- as reqd
• Petroleum jelly	- as reqd
• Cleaning cloth	- as reqd
• Cleaning brush 2 inch	- 1 No
• Goggles	- 1 No
• Hand gloves	- 1 No
• Baking soda	- as reqd

> **Safety precaution: Always wear the necessary protective clothing when working with a battery, especially gloves and safety goggles.**

• Do not keep the screw driver, spanners or any tools on the battery, as it may short circuit the terminals.

• Do not wear metallic watch strap or bangles while working with batteries.

• Carry out the exercise in a well ventilated, dry and level place.

PROCEDURE

TASK 1 : **Inspection of the battery type, terminal voltage and Ampere hour rating**

1 Examine the outside appearance of the battery.

2 Observe the details marked in the label on battery.

3 Check the battery type, voltage and ampere hour rating and note down the details in Table - I.

4 Inspect for any fluid in and around the battery for elctrolyte is spilling or leaking out.

5 Check cables, clamps, and housing for obvious damage or loose connections.

6 Look closely for loose or damaged terminal clamps; ensure that the battery cables are intact. (Broken or frayed cables are extremely hazardous-Replace if found damaged).

7 Tight all wiring/connections from the battery.

8 Get the work checked by the Instructor.

Table - 1

SI No.	Battery Type	Voltage	Ampere hour Rating	Remarks

— — — — — — — —

TASK 2 : **Testing the battery condition**

1 Discount the loads from the batteries and clean the terminals using the cleaning brush dipped in the mixture of baking soda and water.

2 Use the cleaning cloth and wipe the battery clean.

3 Measure the Voltage across battery terminals using Digital multimeter.

4 Compare the measured voltage with the readings mentioned in the Chart-1.

5 Get the work checked by the Instructor.

Chat showing the relation with open circuit voltage, specific gravity and percentage of charge

Open - Circuit Voltage						Specific gravity corrected to	Percentage of Charge
6V	8V	12V	24V	36V	48V		
6.37	8.49	12.73	25.46	38.20	50.93	1.277	100
6.31	8.41	12.62	25.24	37.85	50.47	1.258	90
6.25	8.33	12.50	25.00	37.49	49.99	1.238	80
6.19	8.25	12.37	24.74	37.12	49.49	1.217	70
6.12	8.16	12.27	24.48	36.72	48.96	1.195	60
6.02	8.07	12.10	24.20	36.31	48.41	1.172	50
5.98	7.97	11.89	23.92	35.87	47.83	1.148	40
5.91	7.88	11.81	23.63	35.44	47.26	1.124	30
5.83	7.77	11.66	23.32	34.97	46.63	1.098	20
5.75	7.67	11.51	23.02	34.52	46.03	1.076	10

— — — — — — — —

TASK 3 : **Testing electrolyte level and charging the battery**

1 Open the vent caps from the battery.

2 Check the electrolyte level inside the battery visually for the top of plates are exposed or immersed in electrolyte in all the cells.

> **Note: If the plates are exposed, top up of distilled water is required.**

3 Add distilled water till the plates are covered approx 3 mm.

4 Repeat the above steps for all the cells and ensure the same level in all the cells of the battery; tightly close all the vent caps.

5 Connect the battery charger and set the battery under charge with recommended voltage/current settings.

6 Get the work checked by the Instructor.

— — — — — — — —

TASK 4 : **Maintaining the battery**

1 Check that all vent caps of the battery are tightly in their place.

2 Remove the connectors from the battery terminal by moving them from side to side and gently pulling them up.

3 Dip the wire brush into the solution of baking soda mixed with distilled water and clean the terminals of the battery as shown in Fig 1.

4 Clean the battery top with brush using the solution of baking soda and water.

5 Clean with water and dry using a clean cloth.

> **Note: When cleaning do not allow any cleaning solution or other foreign matter to get inside the battery.**

6 Apply grease to both the battery terminals and reconnect the clamps to the terminals correctly.

7 Get the work checked by the Instructor.

Fig 1

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.4.33

Measure the specific gravity of electrolyte using hydrometer

Objectives: At the end of this exercise you shall be able to
• **Measure the specific gravity of electrolyte in lead acid battery.**

Requirements

Tools/Equipments/Instruments

• Lead acid battery 12V/60 AH   - 1 No
• Battery charger 12V   - 1 No
• Hydrometer   - 1 No
• MC voltmeter 0-15V   - 1 No
• MC Ammeter 0-5A   - 1 No
• Safety googles   - 1 No

Materials/Components

• Distilled Water 500 ml   - 1 Bottle
• Concentrated sulphuric acid   - 200 ml
• Clean Jar for mixing 1 Ltr.capacity   - 1 No

Safety precaution: Near the safety goggles to protect eyes from acid or any dust particles.

PROCEDURE

1 Visually inspect the top surface of the battery; clean the terminals.

Note: If sulphated clean with wet cotton waste or with soda bicarbonate.

2 Unscrew all the vent plugs and check the level of the electrolyte.

Don't clean the battery top surface keeping the vent plugs open . The accumulated dirt may fall inside the cells and form sediments.

3 Insert the hydrometer rubber nozzle inside the battery vertically as shown in Fig 1.

Fig 1
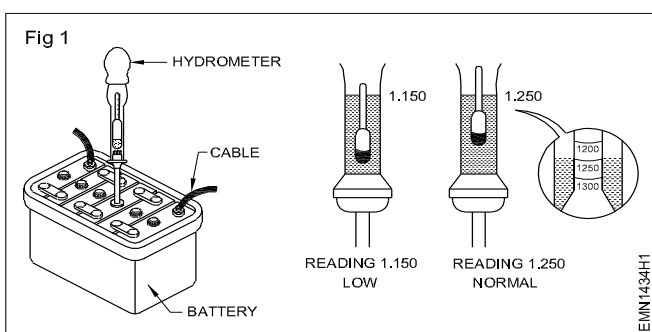
4 Pump the electrolyte upto reference mark by pressing the bulb.

5 Check the initial specific gravity of the electrolyte of each cell using hydrometer and record it in Table 1.

Note:

1 **In a fully charged lead acid cell the specific gravity of the electrolyte should be 1.28 at room temperature.**

2 **When the specific gravity of electrolyte falls down to about 1.150 the cell can be taken as fully discharged.**

6 Record the status of charge condition each cell in Table 1.

7 Get the work checked by the instructor.

Table 1

Cell No.	Specific gravity	Charge condition	Remarks
1			
2			
3			
4			
5			
6			

— — — — — — — —

Test a battery and verify whether the battery is ready for use or needs recharging

Objectives : At the end of this exercise you shall be able to
- **test a battery and verify whether the battery is ready for use**
- **verify whether battery needs recharge.**

Requirements

Tools/Equipments/Instruments

- Trainees tool kit — 1 Set
- High rate discharge tester — 1 No
- Hydrometer — 1 No
- MC voltmeter 0-15V — 1 No
- Lead acid type 12V — 1 No

Materials/Components

- Cotton waste — as reqd
- Test probes with crocodile clip — 1 Pair

PROCEDURE

TASK 1 : **Testing the a battery and verifying whether battery is ready for use**

1 Clean the terminals; measure the cell voltage and battery voltage using voltmeter; record the observations in Table 1.

2 Check the level of the electrolyte in the battery

3 Measure the specific gravity of electrolyte of each 3 cell with hydrometer and record the observations in Table 1.

4 Observe whether the specific gravity is 1.28.

5 See whether the level of electrolyte is above the level of eletro plate.

6 If all the above test results are satisified, then the battery is ready for use.

Fig 1

READING 1.150 LOW   READING 1.250 NORMAL
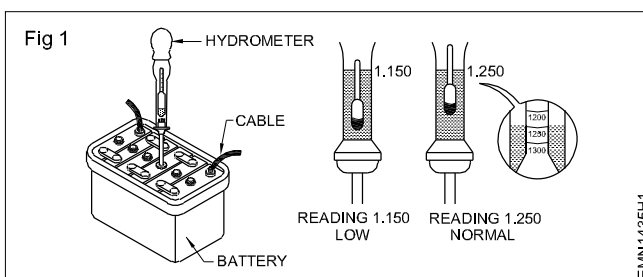
Table 1

Cell No.	Measured voltage	Specific gravity	Condition	Remarks
1				
2				
3				
4				
5				
6				

— — — — — — — —

TASK 2 : **Verifying whether battery needs recharge or not**

1 Check the battery for its working voltage under load using a high rate discharge tester for a short period say within 5 seconds.

2 Observe whether each cell voltage is below 1.8V.

3 Measure the specific gravity of electrolyte of each cell with a hydro meter.

4 observe whether the specific gravity is below 1.24.

5 If all the test results are in the above condition then the battery needs recharge.

Fig 2

THREE 2 V CELLS CONNECTED IN SERIES HIGH RATE DISCHARGE TESTER CONNECTED ACROSS A CELL

— — — — — — — —
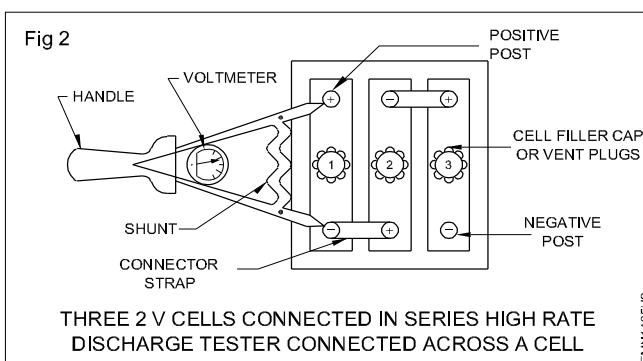
Use the multimeter to measure various functions (AC V, DC V, AC I, DC I, R)

Objectives : At the end of this exercise you shall be able to
- **identify available ranges in the given multimeter**
- **measure voltage and current of DC supply**
- **measure voltage and current of AC supply**
- **measure resistance (continuity) of a switch.**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Battery 1.5V AA Size	- 1 No
• DC RPSU unit, 0-30V/5A	- 1 No	• Lead-acid battery, 12 volts	- 1 No
• Auto transformer, 0-270V/1A	- 1 No	• Assorted value of resistor	- 5 Nos
• Digital multimeter with probes	- 1 Set		

PROCEDURE

TASK 1: **Study on Multi-meter**

1 In the given multi-meter, check the available ranges scales and other information and record these details in Table -1.

2 Check the symbol on meter indicating its placement position. In the case of analog multimeter, carryout mechanical zero setting of the meter.

3 Connect the meter prods ensuring proper colour of probes at meter terminals.

Table 1

a Name of the given multimeter & model number.

b Manufacturer name.

c List of input socket available on the meter.

d List the available measuring ranges and scale marking on the meter.

Table 1

DC Voltage		AC Voltage	
Range No.	**Voltage Range**	**Range No.**	**Voltage Range**

DC Current		AC Current	
Range No.	**Current Range**	**Range No.**	**Current Range**

Resistance Ranges:

Range No.	Ohms Range

— — — — — — — —

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TASK 2: **Measurement of DC voltage**

1 Set the meter range switch to measure cell voltages and choose the scale for taking readings. Record the chosen range position and scale in Table 2.

2 Measure and record the voltage of cell & battery in Table 2.

3 Set the meter range to measure the unknown DC voltage from the regulated DC power supply unit (RPSU).

4 Measure the output voltage of RPSU. Change the set range if necessary to measure the set RPSU voltage more accurately. Record the measured voltage in Table 2.

Table 2: DC Voltage measurement

Sl.No.	Source of DC Voltage	Label Marked set voltage	Measured voltage
1	AA size battery		
2	Battery, 12V/9V		
3	RPSU output		

— — — — — — — —

TASK 3: **Measurement DC current**

1 Set the multimeter to measure an unknown DC current.

2 Connect the meter terminals as shown in Figure 1.

3 Measure and record the readings shown by the meter in Table 3.

4 Change the set range if necessary to measure the current more accurately.

5 Change the resistor value and measure different current values in Table 3.

Table 3: DC Current Measurement

Sl.No	Set current range	Measured current
1		
2		
3		

Fig 1

REGULAR DC POWER SUPPLY UNIT

OUTPUT

RESISTOR

MULTI METER

DC CURRENT MEASUREMENT USING MULTI-METER

EMN1536H1

— — — — — — — —
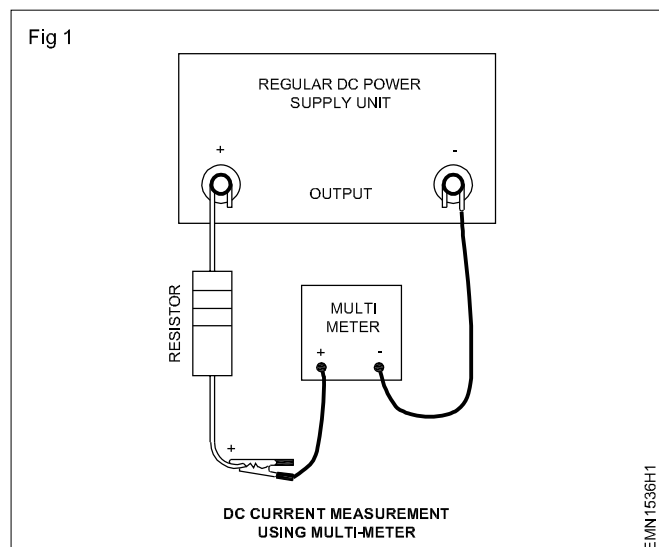
TASK 4: **Measurement of AC voltage**

1 Set the multi-meter to measure higher AC voltage.

2 Connect the meter terminal to a variable AC source (Auto-transformer).

3 Measure and record the readings shown by the meter in Table-4. Change the set range if necessary to measure the voltage more accurately.

4 Change the set value of AC voltage and repeat step-1 to step-3.

Table 4: AC voltage measurement

Sl.No	Set voltage range	Measured voltage
1		
2		
3		

— — — — — — — —

TASK 5: **Measurement of AC current**

1 Set the multi-meter to measure an unknown AC current.

2 Connect an Auto-transformer to the supply source and set the output voltage to 50V, AC.

3 Connect the meter terminals as shown in Figure 2.

4 Measure and record the readings shown by the meter in Table 5. Change the set range if necessary to measure the current more accurately.

5 Change the resistor value and measure different current values in Table 5.

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Table 5: AC current measurement

Sl.No	Set current range	Measured current
1		
2		
3		
4		
5		
6		
7		
8		

Fig 2

AUTO TRANSFORMER

P   OUTPUT   N

RESISTOR

MULTI METER

AC CURRENT MEASUREMENT USING MULTI-METER

EMN1536H2

— — — — — — — —
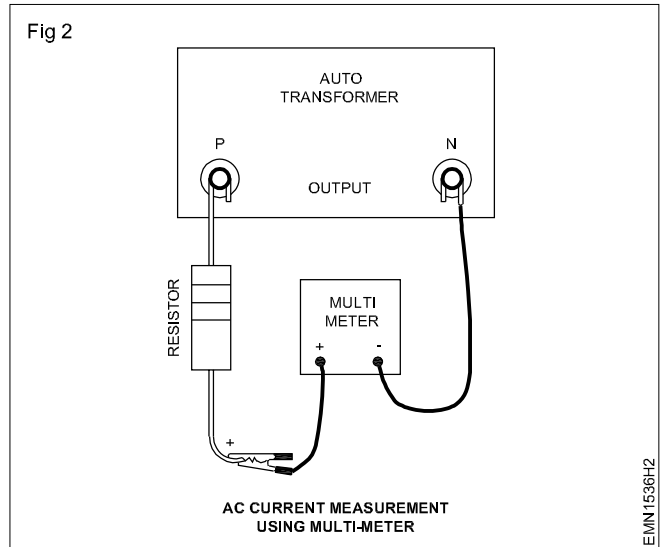
TASK 6: **Measurement of resistance of a switch**

1   Set the multi-meter to continuity range.

2   Check the switch under both two condition.

3   In one position, the meter shows zero reading and gives sound that means the switch is in ON position.

4   In another position, the meter shows 1 at the left side of the display that is high resistance and the switch is in OFF position.

5   Record the observations in the Table 6.

Table 6: Measurement of resistance of a switch

Sl.No	Condition of switch	Resistance
1	ON	
2	OFF	

Fig 3

EMN1536H3

— — — — — — — —

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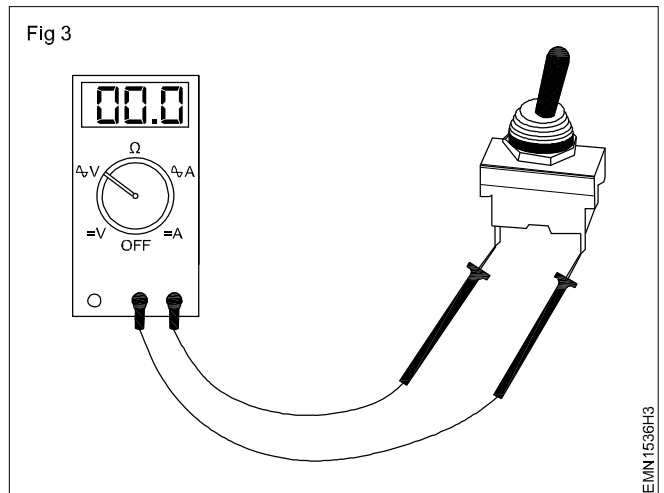
Identify the different types of meter for measuring AC & DC parameters

Objectives : At the end of this exercise you shall be able to
• **identify the type of instruments (AC/DC) and their function from the dial markings.**

Requirements

Tools/Equipments/Instruments

• Voltmeter 0 - 300 V MC   - 1 No
• Ammeter 0-15 A MI panel board type   - 1 No
• Ammeter 0 - 5A MC   - 1 No
• Ohmmeter-shunt and series type   - 1 each
• Watt meter 0-400 kW   - 1 No

• Frequency meter 45-55Hz   - 1 No
• Multi-range voltmeter
  MC 0-75, 150, 300 & 600 V   - 1 No
• Multi-range voltmeter
  MI 0-150, 300 and 600 V   - 1 No
• Power factor meter
  0.5 lead 0-0.5V lag   - 1 No

PROCEDURE

> **The instructor has to label the meters serially before issued to trainees. Provide the chart showing symbols and their respective meaning for identification and reference.**

1 Pick one of the labelled meter; observe the alphabet/ function marked on the center of the dial/panel to identify the parameter/function.

2 Draw the sketch of the meter and record the observation in Table 1.

3 Observe the small symbols printed at the bottom line on the dial/panel.

4 Refer to the chart - 1, identify and compare the symbol and its meaning; record it in Table 2.

5 Repeat the above steps for all the remaining meters and record the observations in Table 2.

6 Get the work checked by the Instructor.

CHART 1
SYMBOLS FOR CHARACTERISING ELECTRICAL MEASURING INSTRUMENTS.

Symbol	Description
	MOVING COIL MEASURING ELEMENT
	MOVING COIL MEASURING ELEMENT WITH RECTIFIER
	MOVING IRON MEASURING ELEMENT
—	TYPE OF CURRENT: ONLY DIRECT CURRENT
∼	TYPE OF CURRENT: ONLY ALTERNATING CURRENT
≂	DIRECT AND ALTERNATING CURRENT
⊥	POSITION FOR USE: VERTICAL
⊏	POSITION FOR USE: HORIZONTAL
1	INDICATION ERROR ±1%
2.5	INDICATION ERROR ±2.5%
3.5	INDICATION ERROR ±3.5%
☆	TEST VOLTAGE: 2 kV=2000 V
⚠	OBSERVE INSTRUCTIONS FOR USE

EMN1537H1

Table 1

Label No.	Sketch of the meter	Type AC/DC	Function	Single/ multi range	Single/ multi scale	Remarks

Table 2

Sl.No.	Symbol on the meter	Description	Sl.No.	Symbol on the meter	Description
1			6		
2			7		
3			8		
4			9		
5			10		

Identify the different controls on the CRO front panel and observe the function of each control

Objectives: At the end of this exercise you shall be able to
- **identify operating controls on the CRO front Panel**
- **observe the function of each front panel control.**

Requirements

Tools/Equipments/Instruments   **Materials/Components**

- 0-20 MHz Dual channel CRO-with
  probe kit and operating manual   - 1 Set

Note: The instructor has to take the xerox copy of front panel of CRO available in the lab; mark serial numbers for each control and issue to tainees.

Provide the operating manual of the CRO to refer the function of each control.

PROCEDURE

TASK 1 : **Identification of operator controls on the CRO front panel**

1 Keep the CRO on the work bench; observe the name of controls printed on each of them on the panel.

2 Refer to the serial numbers marked on the xerox copy for each control from power ON/OFF, note down the name in the Table 1.

3 Refer to the operating manual and note down the functions in Table 1.

4 Repeat steps 2 and 3 for all controls on the CRO front panel.

Fig 1
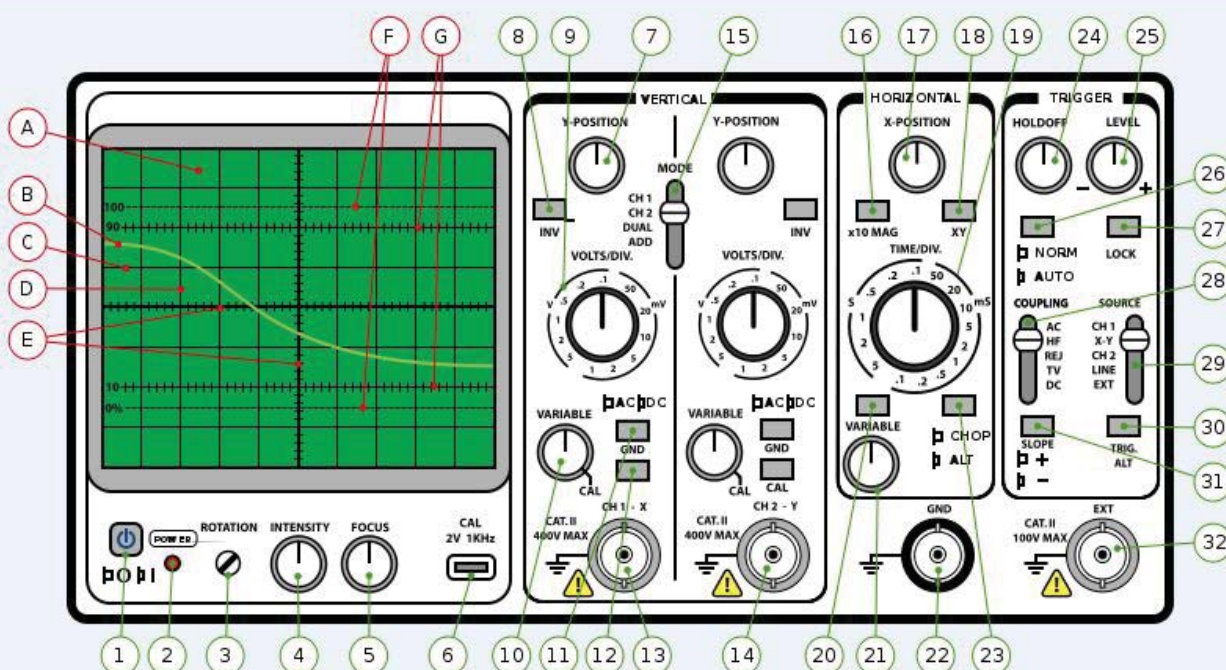
Table I

Label No.	Name of the Front Panel Controls	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
12		
13		
14		
15		

5   Get the work checked by the instructor

— — — — — — — —

TASK 2 : **Observation of function of each front panel control in CRO**

1   Connect the power cord to the CRO and plug it to AC mains supply.

2   Switch 'ON' and allow warm up time till the trace appears on the screen.

3   Adjust intensity and focus controls for a observing effect of size and brightness of trace on the screen, record observation in Table 2.

4   Re adjust the above controls for a sharp trace on the screen.

5   Adjust time/Div control, observe the effect of trace movement and bring back to the previous setting; record observations in Table 2.

6   Adjust horizontal position control, observe the shifting of the trace, bring back to the previous setting; record observations in Table 2.

7   Repeat the step 6 for vertical position control and record observations in Table 2.

8   Connect the output of built in calibration signal to the channel 1 input using suitable cable/CRO probe.

9   Observe the waveform, vary the settings of above controls one at a time and observe the effect on the display.

10 Record the observations in Table 2.

Table 2

Sl. No.	Name of the control	Effect of display on screen
1	POWER - ON/OFF	
2	Intensity	
3	Focus	
4	Time/Div	
5	Horizontal position	
6	Vertical position Ch-1	
7	Vertical position Ch-2	
8	Trigger Int./Ext.	

11 Repeat the steps for remaining controls and record observations.

12 Get the work checked by the Instructor.

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.5.38

Measure V$_{DC}$, V$_{AC}$, time period using CRO sine wave Parameters

Objectives : At the end of this exercise you shall be able to
• **measure D.C. voltage (V$_{DC}$)**
• **measure the values of AC voltage (V$_{P-P}$)**
• **measure the time period of a sine wave parameters.**

Requirements

Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Step-down transformer, 230V/12V,	
• Oscilloscope, 20MHz	- 1 No	200 mA	- 1 No
• RPS, 0-30V, 1A	- 1 No	• Probes for Oscilloscope	- 1 No
• Voltmeter/Multimeter	- 1 No	• Dry cell, 1.5 V	- 1 No
		• Hook-up wire	- 1 m

PROCEDURE

TASK 1 : **Measurement of DC voltage**

1 To measure the voltage of the dry cell, set the volt per division to 0.5 V/Div.

2 Connect the black (ground) probes to the negative end and the red probe to the positive end of the dry cell.

3 Observe the trace on the screen. It will be observed that the trace will move up by 3 divisions from the center line indicating the voltage in positive.

4 The magnitude of the EMF of the cell is given by,

5 Now, reverse the leads, the trace will move down by 3 divisions indicating the voltage is negative and again the EMF of the cell = 3 x 0.5 = -1.5V.

6 Instead of a dry cell use the regulated DC power supply (0-30V) and repeat steps-2 to step-4 and record the observations in Table 1.

Table 1

SI No.	Power supply voltage in volt	Attenuator position	No.of divisions moved up	No.of divisions moved down	Voltage measured in CRO
1					
2					

65
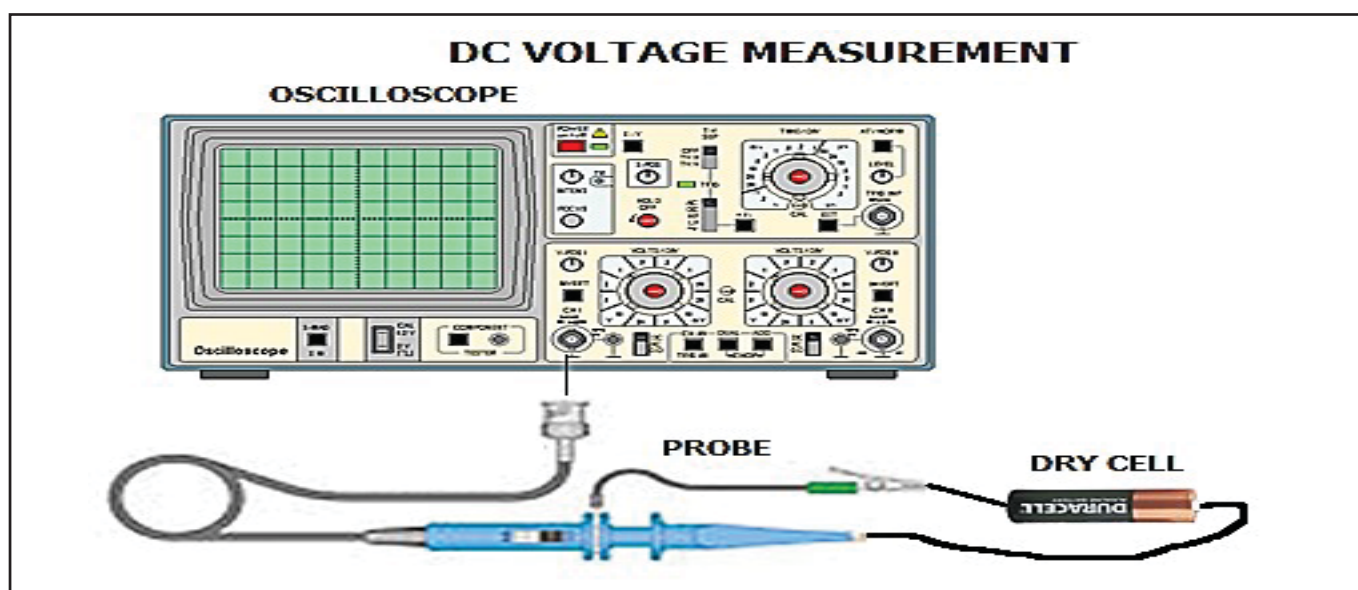
TASK 2 : **Measurement of AC voltage**

1   To measure AC voltages, set the AC-DC switch in (out) AC position.

2   Set the volt per division to 50V, if the input voltage is unknown and adjust the time base switch to 10 milliseconds.

3   Connect a step-down transformer secondary leads one to the common input terminal to the ground side for signal source and another lead to the input terminal.

4   Switch ON the oscilloscope, adjust the trace to center and focus intensity controls for a sharp bright trace.

5   Switch ON and energize the primary of the transformer.

6   Observe the wave form that appears on the screen.

7   Increase the vertical sensitivity by the Volts/Div switch such that the wave form display is clearly seen.

8   Measure the peak to peak voltage of the displayed waveform, by counting the number of divisions between positive and negative peaks. Record the observations in Table 2.

9   Determine the RMS value of the voltage by measuring the voltage across the secondary of the transformer using multimeter.

Table 2

SI No.	Attenuator switch range Volts/Div	No.of divisions counted peak voltage	No.of divisions counted peak to peak voltage	Peak voltage	Peak to peak voltage	RMS voltage (measured by voltmeter)
1						

AC VOLTAGE MEASUREMENT

— — — — — — — —

TASK 3 : **Measurement of time period and frequency of sine wave**

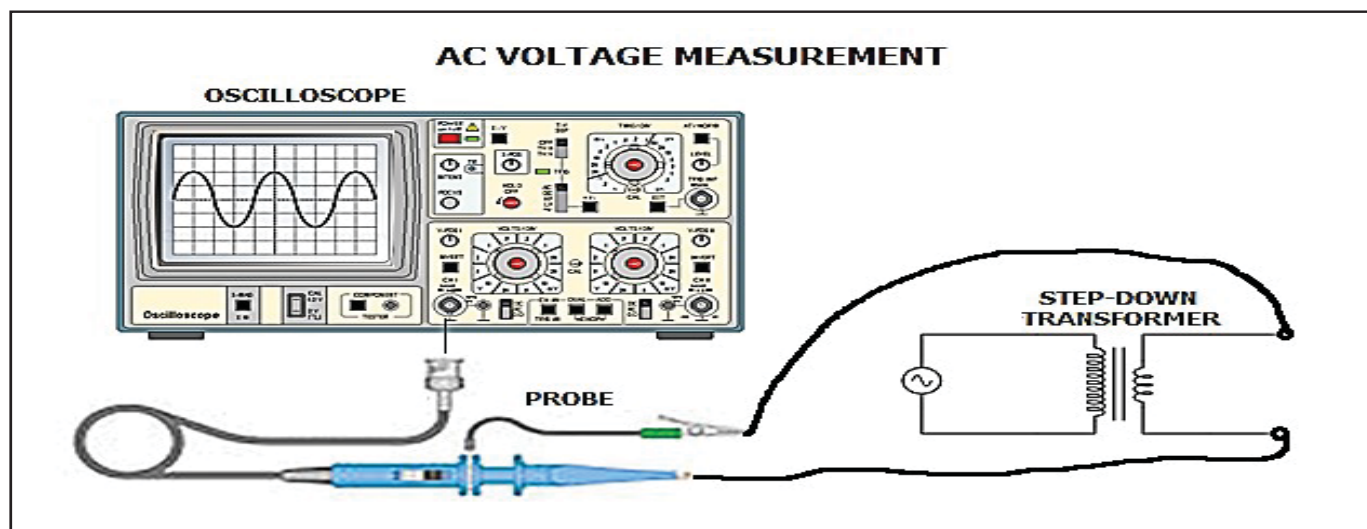1   After measurement of peak to peak voltage in Task 2, turn the time base vernier (1) to CAL position.

2   Set the Time/Div switch to a range where the signal can be clearly seen.

3   Count the number of divisions horizontally for one complete cycle and record the same in Table 3.

4   Calculate the frequency of the displayed wave form the using formula,

Where, T is the time period in seconds. Enter the values in Table 3.

5   Formula to be used:

Time period (T) = Time base range x No. of divisions/ Cycles.

Frequency (f) = 1/T Hertz.

Table 3

SI No.	Attenuator switch range Time/Div	No.of divisions per cycle	Time period (T)	Frequency f=1/T Hertz
1				

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.5.39

Identify the different controls on the function generator front panel and observe the function of each controls

Objectives: At the end of this exercise you shall be able to
• **identify the different front panel control in function generator**
• **observe the function of each front panel control in function generator.**

Requirements

Tools/Equipments/Instruments	Materials/Components
• 0-20MHz CRO-dual channel with probe kit and operating manual - 1 Set • Function generator with operating instruction manual - 1 No	

> **The instructor has to use the xerox copy of the front panel of function generator available in the lab. Mark each control with serial numbers for identification/function of them and provide to trainees.**

PROCEDURE

TASK 1 : **Identification of different controls on the Function generator front Panel**

1 Keep the function generator on the work bench; observe the name of controls printed on each of them.

2 Start from label No.1, refer to the identify and note down name of the control in Table 1.

3 Repeat to the operating/Instruction manual of the function generator and note down the function control in Table 1.

4 Repeat the above step for all the labelled controls and record their name in Table 1.

5 Get the work checked by the Instructor.

Fig 1
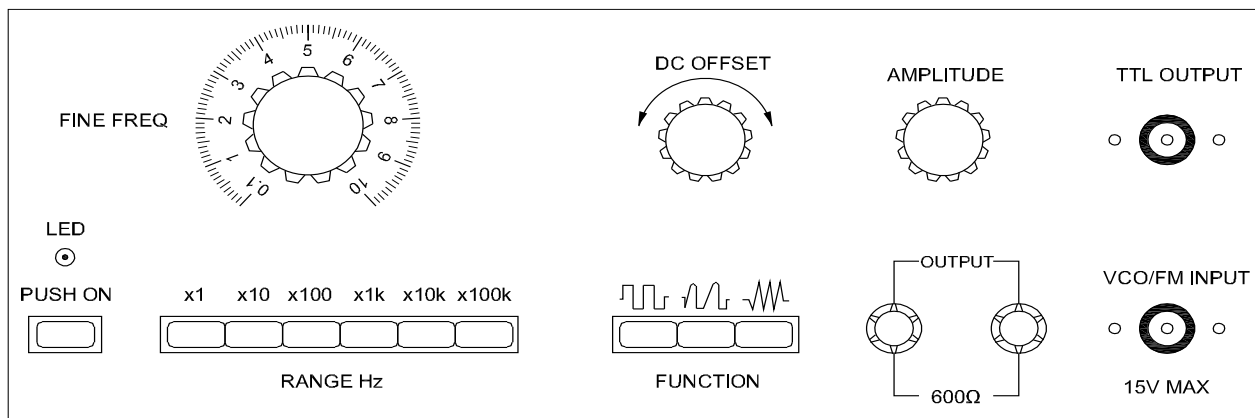
FRONT PANEL OF FUNCTION GENERATOR

EMN1540H1

Table - 1

Label No.	Name of the Front Panel Controls	Function
1		
2		
3		
4		
5		

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Table - 2

Label No.	Name of the Front panel control	Function of control waveform/frequency amplitude	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Note:

- **The instructor has to guide the trainees for identification of controls/sockets or switches on the rear panel of the function generator and record them in Table 3.**
- **If more controls are available, make the trainees to observe under separate task following above procedure.**

— — — — — — — —

TASK 2 : **Observe the functioning of each control on the front panel of function generator**

1 Connect the output of function generator to the channel-1 input of CRO as shown in Fig 2 using BNC cable/connector.

Fig 2

FUNCTION GENERATOR
OUTPUT
CRO CH-1

EMN1540H2
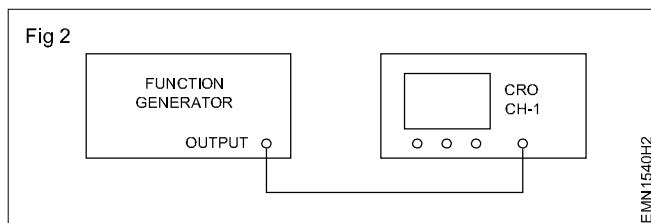
2 Switch ON the CRO; allow warm-up time, adjust controls and prepare CRO for measurements.

3 Switch ON the function generator; operate the frequency select control, amplitude etc. One at a time and observe the waveform on CRO screen by varying their position.

4 Record the observation in table 2; operate other controls, observe corresponding change in waveform/frequency/amplitude and record them in Table 2.

5 Repeat the steps for all the controls on the front panel and record observations.

6 Get the work checked by the Instructor.

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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.5.40

Practice soldering on different electronic components, small transformer and lugS

Objectives : At the end of this exercise you shall be able to
• **tin the ends of hookup/flexible wires/lug terminals**
• **Solder different electronic components on lug terminals**
• **Solder a small transformer on a general purpose PCB.**

Requirements

Tools/Equipments/Instruments

|	
• Soldering iron 25W/240V	- 1 No
• Trainees tool kit	- 1 Set
• Cleaning brush, 1/2inch	- 1 No
• Step down transformer 240V/6V 300mA	- 1 No
With flexible wire termination	

Materials/Components

• Lug board (Code No.103-06-LB)	- 1 No
• Single strand wire(hook-up-wire)	- 1 m
• Solder wire 60/40 18 SWG	- 25 gms
• Soldering flux	- as reqd
• Gen purpose PCB (Type 107)	- 1 No
• Soldering iron stand	- 1 No
• Electronic components assorted items	- as reqd

Note:The instructor has to ensure that the trainees keep the soldering iron on its stand and no electrical leakage on its metal body;

Guide the trainees to keep the tip of the soldering iron bit tinned.

PROCEDURE

TASK 1 : **Tinning the lug terminals**

1 Visually check the lug terminals on the lug board are clean and bright.

2 Scrape the dirt/oxide layer on both sides of the lug terminal using a knife and clean all the lug terminals on the lug board.

3 Apply a thin layer of flux on the face of lug terminal as shown in Fig 1a.

Fig 1
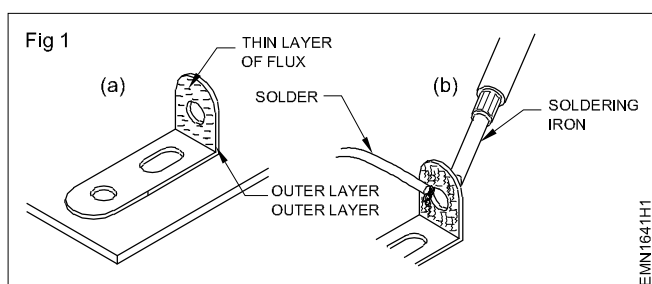
Note: Properly tinned tip of the soldering iron bit is in bright shining, silvery colour; The molten solder on the tip of soldering iron is essential for efficient transfer of heat for soldering or desoldering process.

4 Touch the lug by molten solder on the bit of soldering iron at the lug no.1 as shown in Fig 1(b).

5 Hold the tip of solder wire at the outer face of the lug as shown in Fig 1b.

6 Take out the solder wire within 2 to 3 seconds time as the solder melts on the lug and take out the soldering iron tip from the lug.

7 Allow the molten solder to solidify over the lug.

Do not blow air to cool the solder on the lug.

9 Get the work checked by the Instructor.

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TASK 2: **Soldering of wire/electronic components on lug terminals**

1 Mark 10 mm and skin the insulation at both ends of hook up wire piece.

2 Scrape the conductor using knife, apply flux and tin the conductor ends.

3 Insert and bend the tinned wire in lug 1 hole as shown in Fig 2. (side entry method).

Fig 2
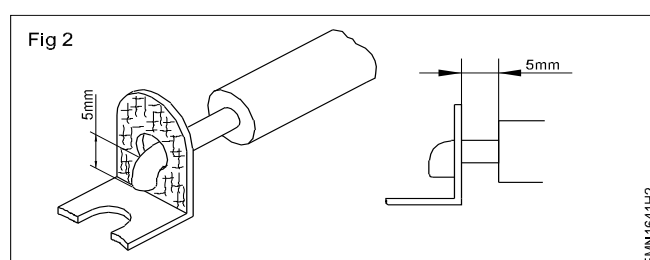
4 Touch the lug by the molten solder on the bit of soldering iron a shown in Fig 3a and hold it for 2 seconds.

Fig 3

(a)

(b)

(c)

EMN1641H3
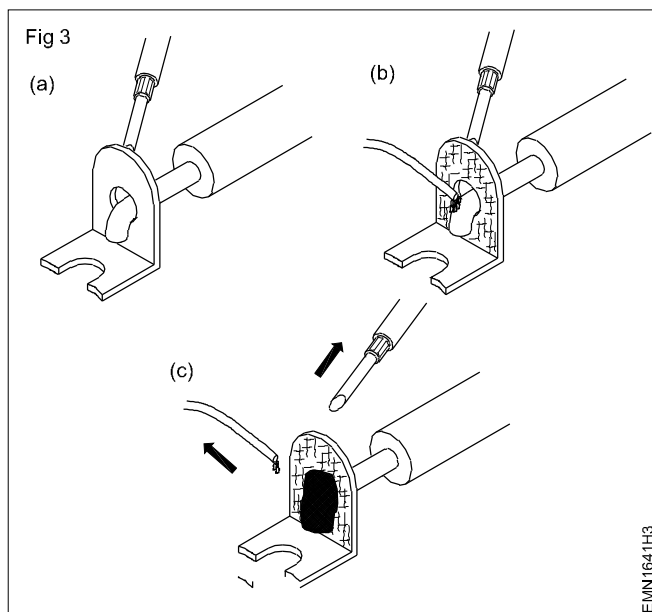
5 Apply the tip of solder wire on the lug; as the solder starts melting, take out the solder and within 2 to 3 seconds remove the soldering iron tip from the joint.
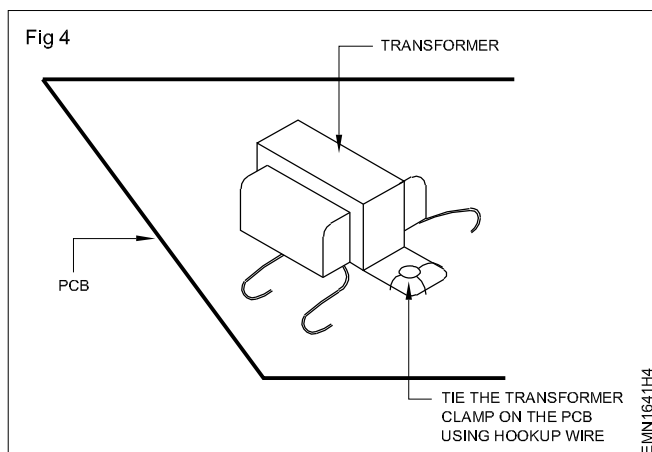
TASK 3: **Soldering the transformer on PCB/Lug board**

1 Position the transformer on the component side of the general purpose PCB as shown in Fig 4 and tie it on PCB using hookup wire.

Fig 4

TRANSFORMER

PCB

TIE THE TRANSFORMER CLAMP ON THE PCB USING HOOKUP WIRE

EMN1641H4

> **Precaution: Due care to be exercised with the hot soldering iron, molten/melting solder.**
>
> **Keeping the soldering iron tip for more than 2-3 seconds will damage the insulation of the wire.**

6 Allow the molten solder to solidify with the wire joined on the lug terminal.

7 Do not shake the wire till the soldered joint on the lug terminal becomes smooth and shiny.

8 Repeat the above steps for tinning all the lugs on the lug board.

9 Select the electronic component to be soldered on the lug terminal (Resistor/Diode).

10 Scrape/clean both ends of the component and tin them.

11 Insert the timed lead into lug terminal 2, as shown in Fig 2.

12 Repeat steps 4 to 7 for a smooth and shiny soldered joint.

13 Get the work checked by the Instructor.

— — — — — — — —

2 Mark 10 mm and skin the insulation at the end of wire; twist the bunch of multi stranded conductors into a single core and tin it.

3 Repeat the above step for all the wires on primary and secondary sides of the transformer.

4 Identify suitable points on the PCB for soldering the primary and secondary wires.

5 Insert the timed terminals at the identified points and solder them correctly.

6 Arrange the lead dress of wires neatly on the PCB after soldering work.

7 Get the work checked by the Instructor.

> **Follow steps in Task-2 to solder the transformer terminals to the lug board.**

— — — — — — — —

Practice soldering IC bases on PCBs

Objectives: At the end of this exercise you shall be able to
• **soldering IC bases on PCB**
• **inspect the soldered joints of IC bases on the PCB.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees tool kit	- 1 Set	• General Purpose PCBs (IC base fixing type)	- 1 No
• Soldering Iron, 25W	- 1 No	• IC base (8 pin or 14 pin)	- 1 No
• Magnifier with lamp and crocodile clip fixture attachment	- 1 No	• Solder Wire 60/40 18 SWG	- as reqd
		• Flux	- as reqd
		• Soldering iron stand	- 1 No
		• Desoldering Wick	- as reqd
		• Soldering tip cleaning sponge	- as reqd
		• Cleaning brush	- 1 No
		• IPA solution	- as reqd

PROCEDURE

TASK 1: Soldering the IC base on PCB

1 Inspect the copper clad/solder side and component side of the selected PCB is suitable for soldering work.

2 Check all the pins of the IC base in correct shape as shown in Fig 1a & b.

Fig 1a
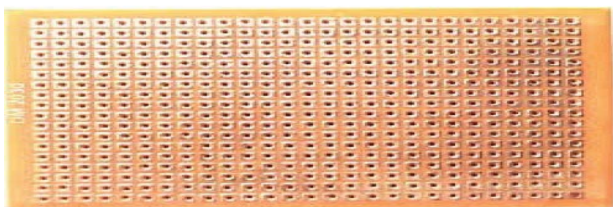
Fig 1b

3 Plan and decide the location on the PCB for the IC base soldering work.

4 Insert the IC base pins through the component side as shown in Fig 2 and press till it sits correctly on the PCB.

Fig 2
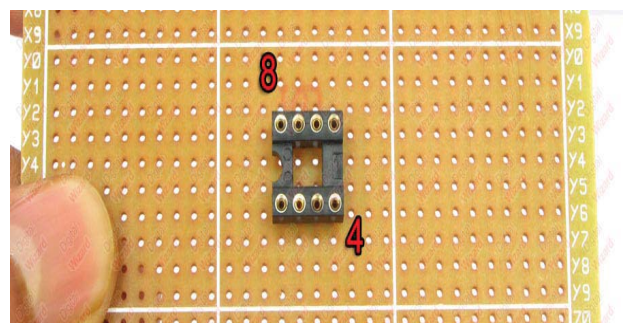
5 Prepare the soldering iron for soldering work; apply a small quantity of flux on each pin of the IC base.

6 Solder the pin no. 1 onto the pad quickly within 1 to 2 seconds time.

Safety precaution: Avoid over heating the PCB track/pad.

If the time taken to solder the pin is more, the heat produced by the soldering iron tip will make the pad/track to peel off the PCB damaged permanently.

7 Solder the remaining pins of the IC base quickly.

Caution: Do not apply more solder on the pin. Excessive solder may bridge the pads and short circuit them.

8 Clean the flux and other residue on the soldered pins using the IPA solution with cleaning brush.

9   Get the work checked by the Instructor.

— — — — — — — —

TASK 2: **Inspection of soldered IC base pins**

1 Keep the soldered PCB under the magnifying lens using the crocodile clip fixture attachment as shown in Fig 3.

Fig 3

2 Switch ON the lamp, adjust the height of lens and observe the soldered pins with clarity.

3 Inspect the pins are soldered correctly and no excessive solder is bridging the pin connections/pads or tracks causing short circuit.

4 Desolder the excess solder if found bridging between pins/pads/tracks using soldering iron.

5 Clean the desoldered spot and inspect under the magnifier.

6 Ensure that all the pins of IC base is correctly soldered and no defect found.

7 Get the work checked by the Instructor.

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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.6.42

Practice desoldering using pump and wick

Objectives : At the end of this exercise you shall be able to
• **desoldering components from PCB using desoldering pump**
• **desoldering component using desoldering wick.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees tool kit	- 1 Set	• Desoldering wick	- as reqd
• Soldering iron, 25W	- 1 No	• Cleaning solution (IPA)	- as reqd
• Desoldering pump (plunger type)	- 1 No	• Flux	- as reqd
• Heat sink plier	- 1 No	• Cleaning Brush	- 1 No
		• Safety goggles	- 1 No
		• Crocodile clip	- 1 No
		• Assembled PCB board for Desoldering work	- as reqd

Note: Check the correct functioning of desoldering pump by closing the nozzle and press the plunger; feel the air pressure. Keep the nozzle closed by a finger and release the button and feel the suction to conform correct working.

PROCEDURE

TASK 1: **Desoldering components from PCB using desoldering pump**

1 Clean the PCB using brush; locate the component to be desoldered fro the PCB as shown in Fig 1.

2 Mark the component lead soldered pad/track on the solder of PCB.

3 Prepare the soldering iron for desoldering work; touch the hot soldering iron top on the marked solder joint as shown in Fig 1.

Fig 1

4 Press the plunger, lock and hold the desoldering pump in left hand; keep the nozzle on the desoldering point, hold the desoldering pump firmly and release the button to suck the molten solder as shown in Fig 2.
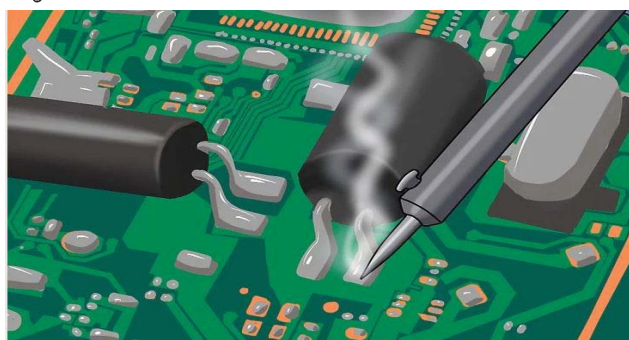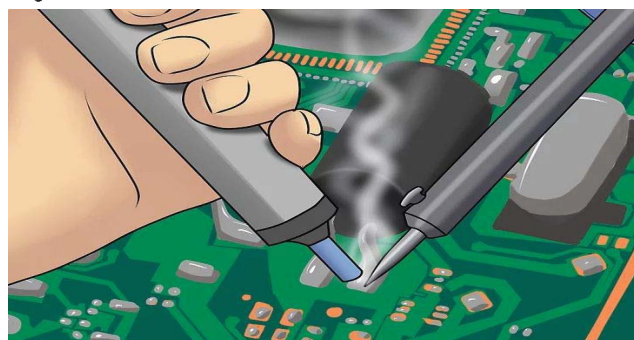

Fig 2

5 Empty the desoldering pump into the trash so that pump is ready for next desoldering ping. (Refer Fig 3)

Fig 3

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6   Repeat steps 3 to 5 on the other marked point also to desolder the molten solder on the joint.

7   Visually inspect for leads of the component are free from the pad and pull the component from top side of PCB using crocodile clip.

— — — — — — — —

TASK 2: **Desoldering components using desoldering wick**

1   Follow the steps 1 to step 3 of task 1.

2   Unwind few inches of solder wick from the coil as shown in Fig 4.

Fig 4

3   Dip the end of wick into the flux and make for a clean removal as shown in Fig 5.

Fig 5
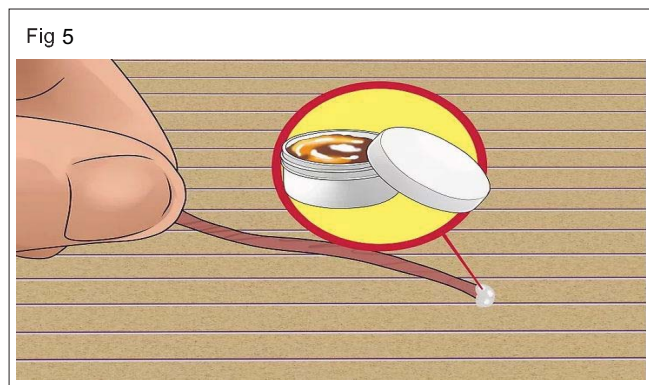
4   Place the braid over the marked soldered joint as shown in Fig 6 for desoldering the component.

Fig 6

8   Get the work checked by the Instructor.
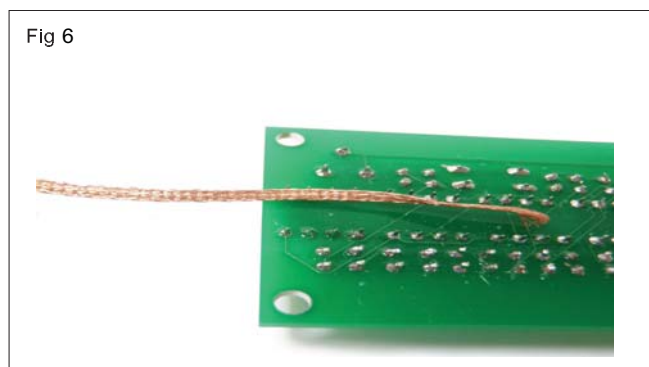
5   Place a hot soldering iron tip over the braid at the desired pin as shown in Fig 7 and allow the molten solder is absorbed by the desolder wick.

Fig 7
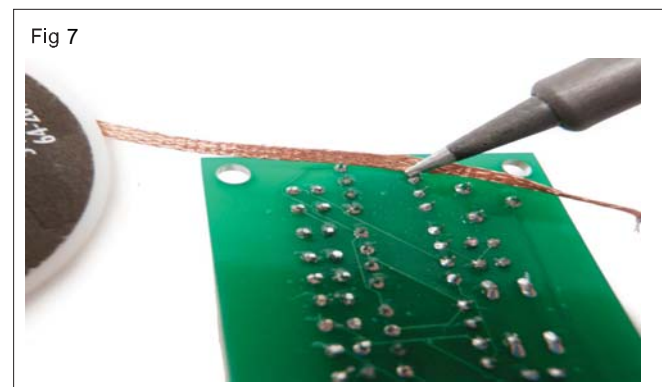
Safety precaution: Do not touch the hot solder wick; keep it away from the PCB.

6   Remove the soldering iron and the braid quickly from the PCB; discard the used portion of the wick.

7   Observe the pad/track on the PCB and ensure the component lead is desoldered from that point.

8   Repeat the above steps for other terminals of component to be desoldered/removed.

9   Clean the PCB using IPA solution with brush.

10 Get the work checked by the Instructor.

— — — — — — — —

Join the broken PCB track and test

Objectives : At the end of this exercise you shall be able to
• **repair the broken PCB track and test the continuity.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Soldering iron 25 watts/240 VAC	- 1 No
• Digital multimeter with probes	- 1 No

Materials/Components

• Tracks cut broken PCB	- 1 No
• Hook up wire	- as reqd
• Epoxy tube	- 1 No
• Emery cloth /paper	- as reqd
• Magnifying glass	- 1 No
• Solder flux	- as reqd
• Rosin cored solder 60/40	- as reqd
• Cleaning brush	- 1 No
• IPA solution	- as reqd

PROCEDURE

1 Identify and inspect the edges of the broken track on PCB using magnifying glass as shown in Fig 1.

Fig 1
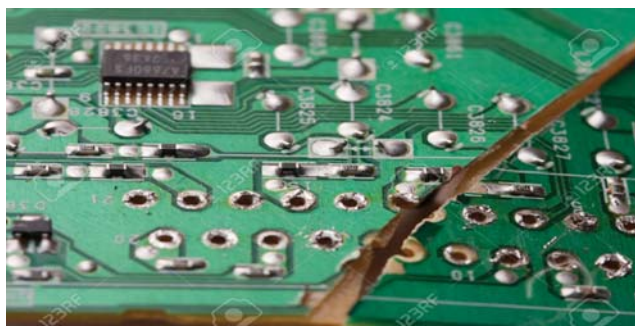
2 Mix the Epoxy according to the manufacturer's instructions and apply a little quantity to one side of the PCB.

3 Position them correctly and Press the two halves of the broken PCB together and hold them until the epoxy sets hard.

Hold both ends together without shaking; the epoxy will set in a few seconds, but should wait for thirty minutes for hardening before proceeding to next step.

4 Scrape/clean the solder mask coating on the broken edges of PCB tracks to be joined.

Sand the ends of these traces until bright copper shows clearly.

5 Plug the soldering iron into mains socket and wait for a while to get ready for soldering work.

6 Cut a piece of hookup wire, take out the bare conductor; scrape it and tin the conductor.

7 Use tweezers and keep the tinned wire over the joined PCB track bridging both sides, solder it along the track.

8 Check the continuity of the repaired track on the PCB.

Precaution: Avoid bridging/shorting with the adjacent tracks/pads on the repaired PCB.

Fig 2
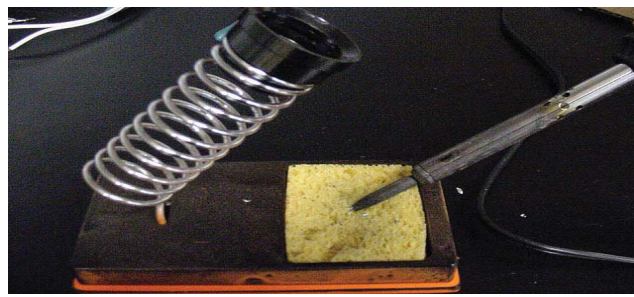
9 Inspect the repaired track using magnifying lens and also the continuity of track using DMM.

Apply appropriate heat to melt the solder. Too much heat will cause the copper pads/tracks to peel off the PCB.

10 Join the other tracks following above steps; finally clean the tracks on the PCB using IPA solution with brush.

11 Get the work checked by the Instructor.

Fig 3

Identify and use SPST, SPDT, DPST DPDT, tumbler. push button, toggle , piano switches used in electronic industries

Objectives : At the end of this exercise you shall be able to
• **identify SPST, SPDT, DPST, DPDT tumbler, push button, toggle and piano switches**
• **test all the switches.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit - 1 Set • Digital multimeter with probes - 1 No	• SPST switch 240V/6A - 1 No • SPDT Switch 240V/15A - 1 No • DPST Switch 240V/15A - 1 No • DPDT Switch 240V/15A - 1 No • Tumbler switch, 1 pole, 240V/16A - 1 No • Push button switch 240V/6A - 1 No • Toggle Switch 240V/6A - 1 No • Piano Switch 240V/6A - 1 No

PROCEDURE

> **The instructor has to label the different types of switches used for this exercise.**

1 Pick one of the labelled switch from the lot, identify the name, type and record it in the table 1.

2 Refer to the chart (Fig 1 to 8) compare verify the details and record it in the Table.

3 Repeat the steps 1 and 2 for the remaining labelled switches and record it in Table 1.

4 Note down the uses of each switch and also draw the free hand sketches of the switches.

5 Get the work checked by the Instructor.

Table 1

S.No	Name of Switch	Free hand sketch	Uses	Remarks
(1)	SPST			
(2)	SPDT			
(3)	DPST			
(4)	DPDT			
(5)	Tumbler			
(6)	Push button			
(7)	Toggle			
(8)	Piano			

Fig 1
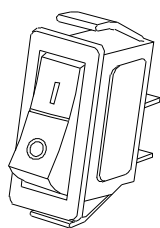
SPST SWITCH

EMN1645H1

Fig 2
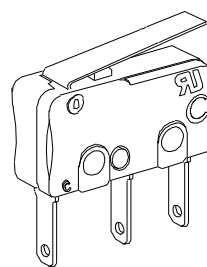
SPDT SWITCH

EMN1645H2

Fig 3
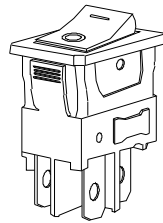
DPST SWITCH

EMN1645H3

Fig 4

DPDT SWITCH

EMN1645H4

Fig 5

TUMBLER SWITCH

EMN1645H5

Fig 6
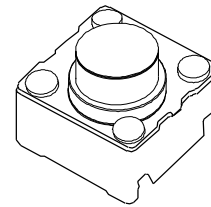
PUSH BUTTON SWITCH

EMN1645H6

Fig 7

TOGGLE SWITCH

EMN1645H7

Fig 8

PIANO SWITCH

EMN1645H8

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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.6.45

Make a panel board using different types of switches for a given application

Objectives : At the end of this exercise you shall be able to
• **draw a schematic diagram to show one electric bell controlled by one push button switch on the panel board.**
• **fix different types of switches on the panel board**
• **wire the cable on the panel board according to the wiring diagram**
• **connect the cables in the accessories**
• **test the circuit.**

Requirements

Tools / Instruments

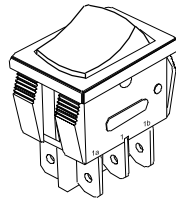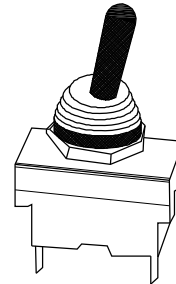|	
• Screw driver 150mm	- 1 Set
• Cutting pliers 200 mm	- 1 No
• Hand drilling machine with 3mm/ 4 mm drill bit each one	- 1 No
• Electrician Knife	- 1 No
• Side cutting plier	- 1 No
• Trainees tool kit	- 1 Set
• Try square 150mm	- 1 No
• Poker 200 mm	- 1 No

Materials

• Wooden Panel Board available in the section	- 1 No
• Bell push switch 6A,240V (Surface Mounting)	- 1 No
• Electric bell 240V	- 1 No
• Wood Screws	- as reqd
• SPST	- 1 No
• SPDT	- 1 No
• DPST	- 1 No
• Tumbler switch	- 1 No
• Toggle switch	- 1 No
• Piano switch	- 1 No

PROCEDURE

1 Draw the layout diagram as shown in Fig 1.

Fig 1
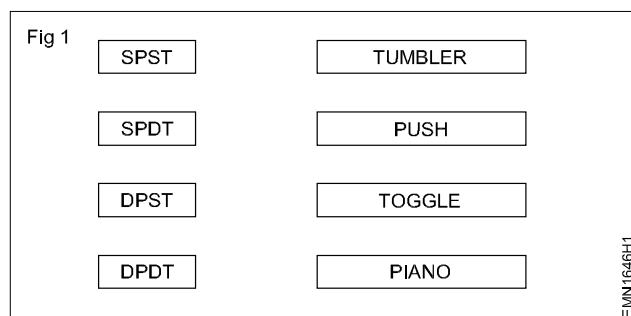
2 Collect the calling bell, SPST, SPDT, DPST, DPDT, tumbler switch, bell push switch, toggle switch and piano switch.

3 Place the switches and calling bell on the panel board to suit the technical aspects.

4 Mark the position of switches on the panel board as per the given layout.

5 Fix the switches and calling bell on the panel board.

6 Prepare the end termination of the cables. Insert them into respective switches.

Fig 2
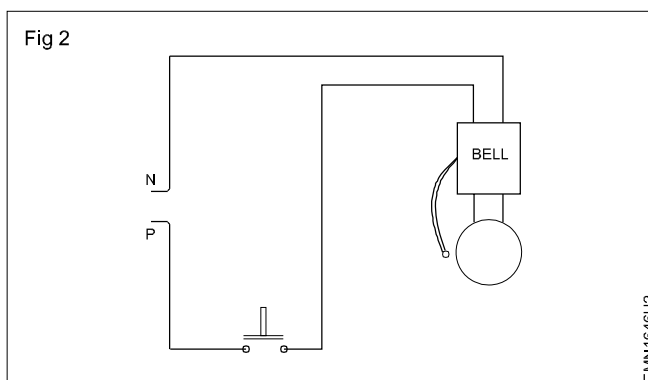
7 Give connections to Bell Push switch and Electric bell as per connection diagram mentioned in Fig 2 and test it.

If it is incorrect make necessary changes.

8 After getting the approval of the instructor connect the main supply and test the circuit.

9 Connect other switches for different applications and get the formed circuit checked by instructor.

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Identify the different types of active electronics components

Objectives : At the end of this exercise you shall be able to
• **identify the different types of active electronics components by referring to the Pictorial representation.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit	- 1 Set
• Magnifying Glass	- 1 Set
• Components Data Sheet with Lead Identification	- 1 No

Materials/Components

• Diodes	- 1 No
• Zener Diode	- 1 No
• Transistor	- 1 No
• Unijunction Transistor(UJT)	- 1 No
• Field Effect Transistor (FET)	- 1 No
• DIAC	- 1 No
• TRIAC	- 1 No
• Silicon Controlled Rectifier (SCR)	- 1 No
• Integrated Circuit (IC)	- 1 No

PROCEDURE

> **Note: Instructor shall label the active components used for this exercise.**

1 Pick one of the labelled active components from the given lot.

2 Identify the components name from the Pictorial representation (Shape, Leads, Colours).

3 Record the names, code No. and number of Pins of the components in Table-1.

4 Repeat the step-2 & 3 for the remaining components.

5 Get the work checked by the Instructor.

Table 1

Sl.No.	Component	Free hand sketch	Device symbol	Remarks
1	LDR			
2	DIODE			
3	LED			
4	Zener Diode			
5	Transistor			
6	SCR			
7	TRIAC			
8	DIAC			
9	UJT			
10	JFET			
11	IC			

— — — — — — — —

Measure the resistor value by colour code and verify the same by measuring with multimeter

Objectives : At the end of this exercise you shall be able to
• **determine resistance value by colour code**
• **determine resistance value by typographic/numeric code**
• **measure resistance value using ohmmeter/multimeter.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees Tool Kit	- 1 Set	• Different types of fixed	
• Multimeter with probes	- 1 No	value resistors	- 10 Nos
• Electrician Knife	- 1 No	• Cotton cloth	- 1 No

The Instructor has to label the different values of fixed resistors.

PROCEDURE

TASK 1: **Calculation of Resistor value from Colour bands**

1 Pick one of the labelled resistor from the given lot and identify the colours of bands starting from one end of the resistor. Observe and record colours of the bands in Table-1. (Refer chart 1)

2 Calculate the resistor value using color code and record values in Table 1.

3 Also find the tolerance of the resistors and record.

4 Scrape the resistor leads using knife to remove oxide/varnish layers on the leads.

5 Using a cloth wipe the leads to make them free from moisture, oil, etc.

6 Short meter probes and adjust the zero set knob of the meter and carry out the resistance zero setting of the meter.

Do not touch the leads of the resistor while measuring. This will make the meter show the body resistance and not the resistor under measurement.

7 Set the meter to the suitable resistance range.

8 Check and record the values shown by the meter in the Table-1.

9 Compare the measured value and the calculated value of the resistor.

10 Repeat steps-1 to 9 for the remaining colour coded resistors.

11 Get the work checked by the Instructor.

Chart 1

Color	1st Band (1st figure)	2nd Band (2nd figure)	3rd Band (multiplier)	4th Band (tolerance)
Black	0	0	10^0	±1%
Brown	1	1	10^1	±2%
Red	2	2	10^2	
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
Gray	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	±5%
Silver			10^{-2}	±10%

Table 1

Label No.	First Band		Second Band		Third Band		Resistance value using colour code			Tolerance		Meter Measured Value
	Colour	Code	Colour	Code	Colour	Code	decoded value	Maximum value	Minimum value	Colour	Percentage	

— — — — — — — —

TASK 2: **Calculation of resistor value from Typographic Code**

1 Pick a typographically coded resistor from the given lot. Record the printed codes value of resistance and tolerance in Table-2. (Refer chart 2)

2 Check the nominal value of the resistor and record in Table-2.

3 From the tolerance value noted, calculate and record the minimum and maximum value of the resistor.

4 Repeat steps-1 to 3 for the remaining typographically coded resistors.

5 Get the work checked by the Instructor.

Fig 1

Standard Value   = 5600 ohms

Minimum Value

    = 5600 - (5600 x 5%)

    = 5600 - 280

    = 5320 ohms

Maximum Value

    = 5600 + (5600 x 5%)

    = 5600 + 280

    = 5880 ohms

Chart 2

Printed Code Format	Meaning	Example of printed Code	Corresponding Resistance Value
xE	X Ohms	1E	1 Ohms
X	X Ohms	100	100 Ohms
xW	X Ohms	56 W	56 Ohms
xKy	X.y K Ohms	4K7	4.7 K Ohms
x.K	X K Ohms	56K	56 K Ohms
xMy	X.y M Ohms	6M8	6.8 M Ohms
xM	X M Ohms	10 M	10 M Ohms

Fig 2
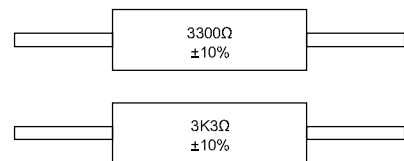
Table 2

Label No.	Printed code on the Resistor	% Tolerance	Resistance value using code			Meter measured value
			Standard Value	Maximum Value	Minimum Value	

— — — — — — — —

Identify resistors by their appearance and check physical defects

Objectives : At the end of this exercise you shall be able to
• **identify different types of fixed resistor by their appearance**
• **check the physical condition of fixed resistors.**
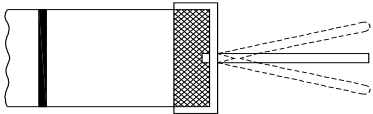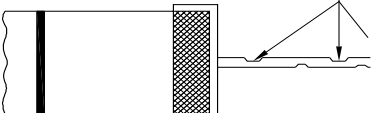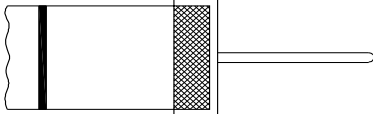
Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit - 1 Set	• Assorted types & Values of Fixed value resistors - 10 Nos

> **The Instructor has to label the different types of resistors used for this exercise.**

PROCEDURE

1 Pick one of the labelled resistor from the given lot.

2 Identify the resistor and observe the following:

   •   Type of Resistor

   •   Lead Type

   •   Physical Defect Refer (Lead Defect Chart)

   •   Overall usability of Resistor

3 Record the observations in Table-1.

4 Repeat step-2 & 3 for the remaining resistors.

5 Get the work checked by the Instructor.

Chart 1

Leads Defects	Defect code	Remarks	Serviceable/unserviceable
SHAKE AT NECK JOINT	Lead Shaky (LS)	May become electrically open, while handling, bending	Unserviceable
LEAD WITH WEAK POINTS	Lead Weak (LW)	Lead may get cut while handling, Bending	Unserviceable
STRONG NECK JOINT & NO WEAK POINTS	Strong Leads (SL)	----	Unservicable
Skin Coating Pealed off	SPE	Value might have deviated	Unserviceable
Body Cracked	BCR	May be open or value deviated	Unserviceable
CAP Shacking/Cracked	CSH	May be open or loose contact	Unserviceable
Body Charred or become	BCH	May be open, short, value deviated	Unserviceable

Table 1

Label No.	Type Name	Lead Type	Physical Defect code	Remarks	Usability of Resistor Serviceable/unserviceable
1					
2					
3					
4					
5					

Identify the power rating of carbon resistors by their size

Objectives : At the end of this exercise you shall be able to
• **identify the power rating of carbon resistors.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit - 1 Set	• Resistors different type and wattages - 10 Nos

> **The instructor has to label the different types, sizes and ratings of carbon resistors used for this exercise.**

PROCEDURE

1 Pick one of the labelled resistor from the given lot.

2 Identify the type of carbon resistors. Refer the chart 1 and observe the details of resistors.

3 Measure the sizes of Carbon resistor.

4 Record the power rating of Carbon Resistor in Table-1.

5 Repeat step-2 & 4 for the remaining resistors.

6 Get the work checked by the Instructor.

Chart 1

Power Ratings	Appearance	Diameter (mm)	Length (mm)	Lead Length (mm)	Lead Diameter (mm)
0.125w (1/8w)		1.8	3	28	0.45
0.250w (1/4w)		2.5	6.5	28	0.6
0.5w (1/2w)		3.2	8.5	28	0.6
1w		5	11	28	0.8

Fig 2
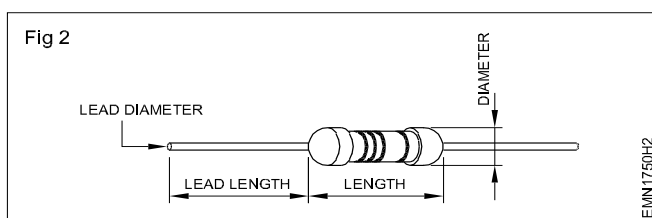
Table 1

Label No.	Type Name	Size	Power Rating in Watt	Remarks
1				
2				
3				
4				
5				

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Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources

Objectives : At the end of this exercise you shall be able to
• **verify Ohm's law and plot the graph.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit	- 1 Set
• Soldering Iron, 230V/25 watts	- 1 No
• Ammeter, 0-30m.A, DC	- 1 No
• Ammeter, 0-10m.A, DC	- 1 No
• Multimeter with probes	- 1 No
• Regulated DC power supply 0-30V/2A	- 1 No

Materials/Components

• SPST Toggle Switch/1A	- 1 No
• Resistor, 1kΩ/1W	- 3 Nos
• Rosin cored solder	- 1 m
• Soldering flux	- 1 Box
• Hook-up wires	- 2 m
• Patch Cords	- 10 Nos
• Lug Board	- 1 No

PROCEDURE

TASK 1: **Measuring current in the circuit with one resistor**

1   Check physical and electrical condition of the given ammeter, meter probes, patch cords, toggle switch soldered on the lug board.

2   Measure and record the resistance value in the Table1.

3   Refer the circuit diagram-1 and assemble the circuit using patch cords.

Fig 1

4   Calculate the theoretical current that is expected to flow in the circuit for a DC supply of 6 Volts. Record the calculated value in Table-1.

Table 1

SI. No.	Resistance Value (R)	Supply Voltage (V)	Circuit current (I)	
			Calcul-ated	Measured
1		6 Volts		
2		9 Volts		
3		12 Volts		

5   Switch ON RPS and set the output voltage to 6 Volts.

6   Switch ON SPST, measure and record the circuit current in the Table-1.

7   Keep the SPST to OFF. Increase the output of RPS to 9 Volts and 12 Volts and record the circuit current.

8   Switch OFF SPST and RPS.

9   From the recorded readings in Table-1, plot a graph of circuit voltage (V) versus circuit current (I) in a graph sheet. (Fig 2)

Fig 2
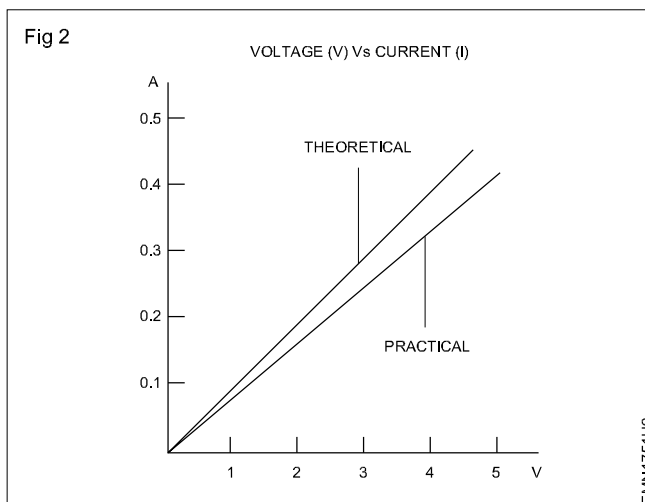
10 Get the work checked by the Instructor.

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TASK 2: **Measuring circuit current with varying circuit Resistances**

1 Refer the circuit diagram-3 and assemble the circuit using suitable patch cords.

Fig 3
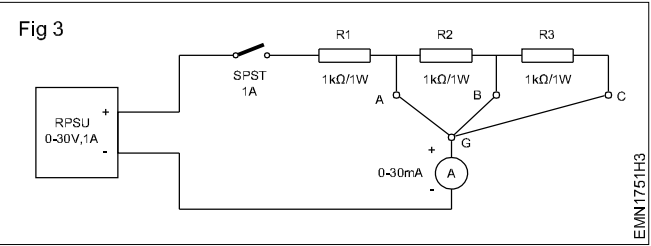
2 Measure the circuit resistance and calculate the theoretical current that is expected to flow in the circuit for a DC supply of 12 volts. Record the calculated value in Table-2.

Table 2

Sl. No.	Set Voltage (V)	Measured Resistance Value (R)	Circuit current (I)	
			Calculated	Measured
1	12 Volts			
2	12 Volts			
3	12 Volts			

3 Switch ON RPS and set the DC voltage to 12 Volts.

4 Connect the terminal "G" with terminal "A". Switch ON SPST. Measure and record the circuit current in Table 2.

5 Switch OFF SPST and connect the terminal "G" with terminal "B". Switch ON SPST. Measure and record the circuit current in Table-2

6 Similarly measure the circuit current under the connection of terminal "G" with "C".

7 Switch OFF SPST and RPSU.

8 From the recorded readings in Table-2 plot a graph of circuit current (I) versus Circuit resistance (R) in graph.

Fig 4
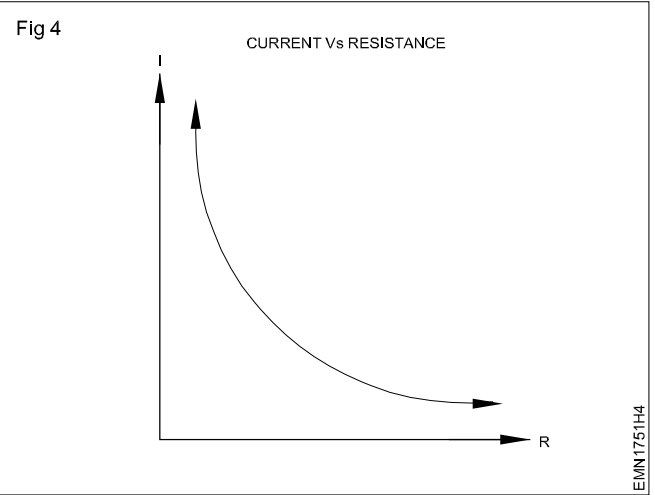
9 Get the work checked by the Instructor.

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Measurement of current and voltage in electrical circuits to Kirchhoff's Law verify

Objectives : At the end of this exercise you shall be able to
• **verify the Kirchhoff's Current Law with three branch circuit**
• **verify the Kirchhoff's Voltage Law with one voltage source.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit	- 1 Set
• Soldering Iron, 230V/25 watts	- 1 No
• Milli-Ammeter, 0-10m.A, DC	- 3 Nos
• Milli-Ammeter, 0-25m.A, DC	- 1 No
• Multimeter with probes	- 1 No
• Regulated DC power supply 0-30V/1A	- 1 No

Materials/Components

• SPST Toggle Switch/1A	- 1 No
• Resistor, 1kΩ/1W	- 3 Nos
• Resistor, 2.2kΩ/1W	- 1 No
• Resistor, 3.3kΩ/1W	- 1 No
• Rosin cored solder	- 1 m
• Soldering flux	- 1 Box
• Hook-up wires	- 2 m
• Patch Cords	- 10 Nos
• Lug Board	- 1 No

PROCEDURE

TASK 1: **Verification of Kirchhoff's Current Law**

1   Check physical and electrical condition of the given ammeter, meter prods, patch cords, toggle switch soldered on the lug board.

2   Make the connections on the Lug board as per the circuit diagram. (Fig 1)

Fig 1

3   With the SPST in OFF position, set the output of Power Supply to 12 volts.

4   Switch ON the SPST switch. Measure and record currents, IT, IB1, IB2, and IB3 in Table-1.

5   Switch OFF SPST and PSU.

6   Write Kirchhoff's current equations at Nodes P and Q. Verify the equation using measured current values.

7   Get the work checked by the Instructor.
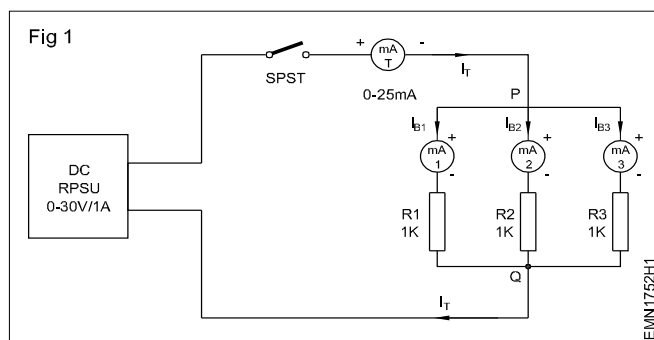
Table 1

RPS Voltage	Total circuit Current I_T	Branch Current I_{B1}	Branch Current I_{B2}	Branch Current I_{B3}	Addition of Branch Current $I_T = I_{B1}+I_{B2}+I_{B3}$
12V					

— — — — — — — —

TASK 2: **Verification of Kirchhoff's voltage law**

1   Check physical and electrical condition of the given meter probes, patch cords, toggle switch soldered on the lug board.

2   Measure and record the values of Resistor R1, R2 and R3 in the Table.

3   Make the connection on the Lug board as per the circuit diagram. (Fig 2)

4   With the SPST in OFF position, set the output of Power Supply to 12 volts.

Fig 2

RPS Voltage	Value of Resistor			Voltage Across Resistor		
	R_1	R_2	R_3	R_1	R_2	R_3
12V						
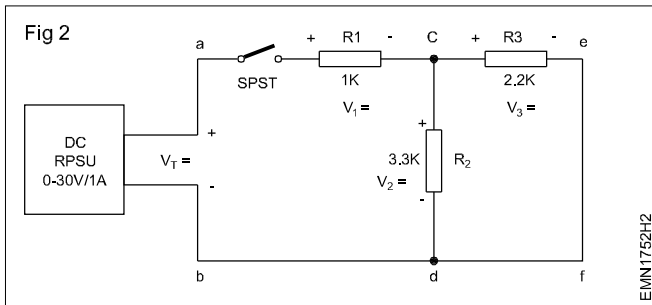
Table 2

5 Mark the polarity of the voltage drops across resistors R1, R2 and R3.

6 Switch ON the SPST switch.

7 Following the voltage polarities marked across the resistors, measure and record the voltage drop across R1, R2 and R3 in Table.

8 Switch OFF SPST and Regulated power supply.

9 Write Kirchhoff's loop equations for the closed paths a-c-d-b-a, a-e-f-b-a and c-e-f-d-a. Substitute the voltage readings recorded in Table in the equations for verification.

10 Verify the equation using measured voltage values.

11 Get the work checked by the Instructor.

Loop:- a-c-d-b-a:

$+V_1 + V_2 - VT = 0$

$+V_1 + V_2 = VT$

Loop:- a-c-e-f-d-b-a:

$+V_1 + V_3 - VT = 0$

$+V_1 + V_3 = VT$

Loop:- c-e-f-d-e:

$+V_3 - V_2 = 0$

$V_3 = V_2$

— — — — — — — —

Verify laws of series and parallel circuits with voltage source in different combinations

Objectives : At the end of this exercise you shall be able to
• **verify the Laws of Series and Parallel circuits with voltage source.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees Tool Kit	- 1 Set	• SPST Toggle Switch/1A	- 1 No
• Soldering Iron, 230V/25 watts	- 1 No	• Resistor, 1kΩ/1W	- 1 No
• Milliammeter, 0-10m.A, DC	- 3 Nos	• Resistor, 2.2kΩ/1W	- 1 No
• Multimeter with probes	- 1 No	• Resistor, 3.3kΩ/1W	- 1 No
• DC Regulated Power supply 0-30V/2A	- 1 No	• 1.5V Pen torch Cell	- 1 No
		• Rosin cored solder	- 10 gm
		• Soldering flux	- 1 Box
		• Hook-up wires	- 2 m
		• Patch Cords	- 10 Nos
		• Lug Board	- 1 No

PROCEDURE

1 Check physical and electrical condition of the given ammeter, meter probes, patch cords, toggle switch soldered on the lug board.

2 Make circuit connection on the Lug board as per the circuit diagram.

Fig 1
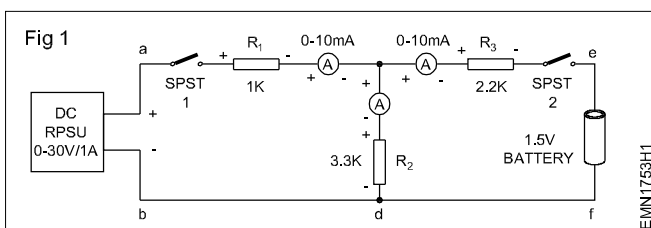
3 With the SPST-1 & 2 in OFF position, set the output of Power Supply to 5 volts.

4 Switch ON the SPST-1 & 2 switch. Measure and record the following currents in Table-1.

   • Current through a to c

   • Current through c to e

   • Current through c to d

5 Measure and record the following voltages in Table-1.

   • Voltage across a to b

   • Voltage across a to c

   • Voltage across c to d

   • Voltage across c to e

   • Voltage across e to f

6 Switch OFF SPST and PSU.

7 From the recorded readings verify the laws of series parallel circuit.

Keep RPS and the two SPST Switches in OFF position while making circuit connection.

Table 1

Current through a to c	Current through c to e	Current through c to d	Voltage across a to b	Voltage across a to c	Voltage across c to d	Voltage across c to e	Voltage across e to f

— — — — — — — —

Measure the resistance, voltage, current through series and parallel connected network using multimeter

Objectives : At the end of this exercise you shall be able to
- **connect the circuit elements in series and test.**
- **measure and verify Voltage, Current, Resistance in series circuit**
- **connect the circuit elements in parallel and test.**
- **Measure and verify voltage, Current, Resistance in parallel circuit.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees Tool Kit	- 1 Set	• SPST Toggle Switch/1A	-1 No
• Soldering Iron, 230V/25 watts	- 1 No	• Resistor 100Ω/½ watts	-1 No
• Ammeter, 0-25mA, DC	- 1 No	• Resistor 150Ω/½ watts	-1 No
• Ammeter, 0-100mA, DC	- 2 Nos	• Resistor 220Ω/½ watts	-1 No
• Ammeter, 0-200mA, DC	- 1 No	• Hook-up wires	- 2 m
• Ammeter, 0-500mA, DC	- 1 No	• Patch Cords	- 10 Nos
• Voltmeter, 0-15 V, DC	- 1 No	• Lug Board	- 1 No
• Multimeter with probes	- 1 No	• Rosin cored Solder	- 1 m
• DC Regulated power supply, 0-30V/2A	- 1 No	• Soldering flux	-1 Box

PROCEDURE

TASK 1: **Measurements on Series Circuit**

1 Connect the resistors in series and also wire up the voltmeters and ammeters as shown in Fig 1.

Fig 1
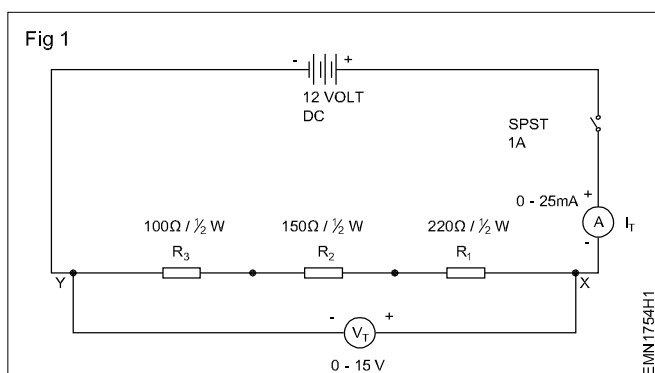
2 Measure resistance across each resistor using multi-meter and record in Table-1.

3 Measure the total resistance using multi-meter between the terminals X & Y.

4 Switch ON the RPSU and set the output voltage to 12 Volts.

5 Close the switch and measure the Current (I_T) and Voltage (V_T).

6 Enter the measured value in Table-1.

7 Switch OFF the supply. Reconnect the ammeter and voltmeter as shown in Fig 2.

Fig 2
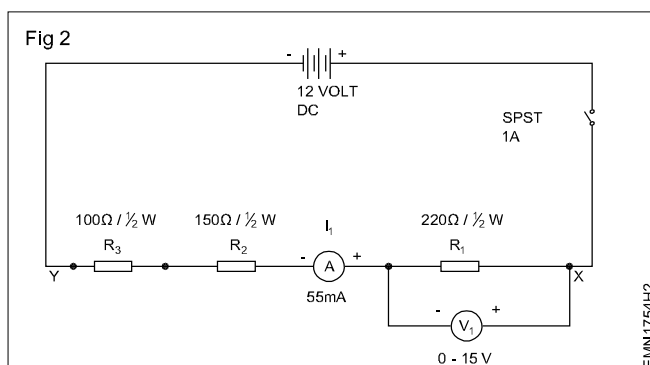
8 Measure and record the Voltage (V_1) and Current (I_1) through Resistor R_1.

9 Switch OFF the supply. Reconnect the ammeter and voltmeter as shown in Fig 3.

Fig 3

10 Measure and record the Voltage (V_2) and Current (I_2) through Resistor R_2.
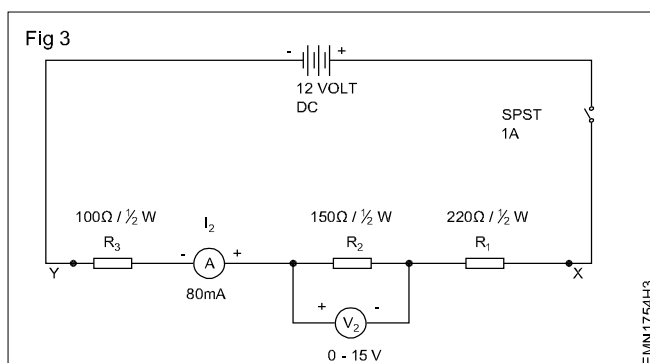
11 Switch OFF the supply. Reconnect the ammeter and voltmeter as shown in Fig 4.

Fig 4

12 Measure and record the Voltage (V_3) and Current (I_3) through Resistor R_3.

13 Calculate total resistance, total current, total voltage using measured values.

14 Verify the laws of series circuit and Compare the values with the calculated values.

15 Get the work checked by the Instructor.

Table 1

R_1	R_2	R_3	R_T	V_T	I_T	V_1	I_1	V_2	I_2	V_3	I_3

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.7.54

Identify different Inductors and measure the values using LCR meter

Objectives : At the end of this exercise you shall be able to
• **identify different types of inductors by their appearance.**
• **measure the value of inductance using Digital LCR meter.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit - 1 set • Digital LCR Meter with manual - 1 No • Electrician Knife - 1 No	• Assorted types and values of inductors - 10 Nos • Hook up wires - 1 m • Cotton cloth/cleaning brush - 1/4 kg

PROCEDURE

> **Instructor has to label the different value of inductors used for this exercise.**

1 Pick one of the labelled inductor from the given lot.

2 Identify the type name, symbol and record it in Table 1. Refer the chart (Fig 1) compare identify and record in Table 1.

3 Measure and record the resistance across the inductor terminals.

4 Switch ON the Digital LCR meter and make the setting for inductance measurement.

5 Connect the inductor across the digital LCR meter and record the inductance value shown by the Digital meter.

6 Repeat the steps-2 to 5 and measure inductance of the remaining inductors, and record in Table 1.

7 Get the work checked by the Instructor.

Table 1

Label No.	Type/Name of Inductor	Symbol	Resistance across coil terminals	Inductance value
1				
2				
3				
4				

Fig 1
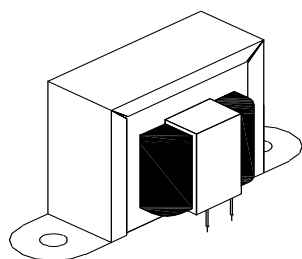
IRON-CORE INDUCTOR
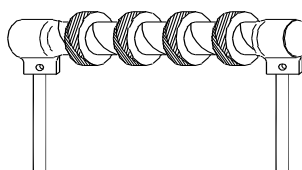
AIR-CORE INDUCTOR
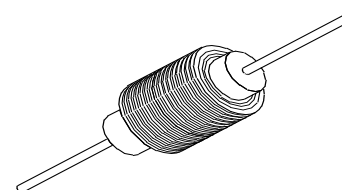
HIGH FREQUENCY INDUCTOR
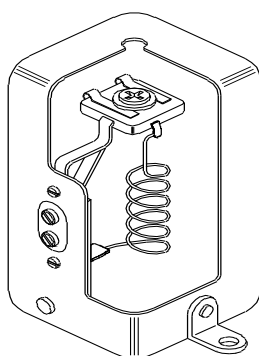
SHIELDED INDUCTOR

TEROID FERRITE CORE INDUCTOR

PRINTED CIRCUIT INDUCTOR

TYPES OF INDUCTORS

EMN1755H1

91

Identify the different capacitors and measure capacitance of various capacitors using LCR meters

Objectives : At the end of this exercise you shall be able to
• **identify different types of capacitors by their physical appearance**
• **determine the capacitance value by typographic codes.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**

Tools/Equipments/Instruments

•	Trainees Tool Kit	- 1 Set
•	DC Regulated Power Supply, 0-30V/2A	- 1 No
•	Digital LCR Meter with manual	- 1 No
•	Ohm meter	- 1 No
•	Electrician Knife	- 1 No

Materials/Components

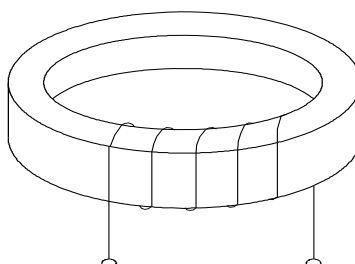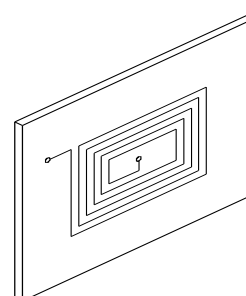|		
•	Assorted types and values of different types of capacitors	- 10 Nos
•	Cotton cloth/cleaning brush	- 1/4 kg

PROCEDURE

The instructor has to label the different types of capacitors used for this exercise.

1   Pick one of the labelled capacitor from the given lot.

2   Identify the type name and record it in Table 1.

3   Refer the typographic code chart (Fig 1) for capacitors. Observe and record the Capacitance value of the capacitor.

4   Prepare LCR meter and connect a capacitor, observe and measure the capacitor value and record in Table 1.

5   Repeat steps-2 to 4 for remaining capacitors and record in Table 1.

6   Get the work checked by the Instructor.

Table 1

Label No.	Type of Capacitor	Capacitor value code	Capacitor value	Capacitor value by measuring LCR meter
1				
2				
3				
4				

Fig 1 CAPACITOR CODING SCHEME
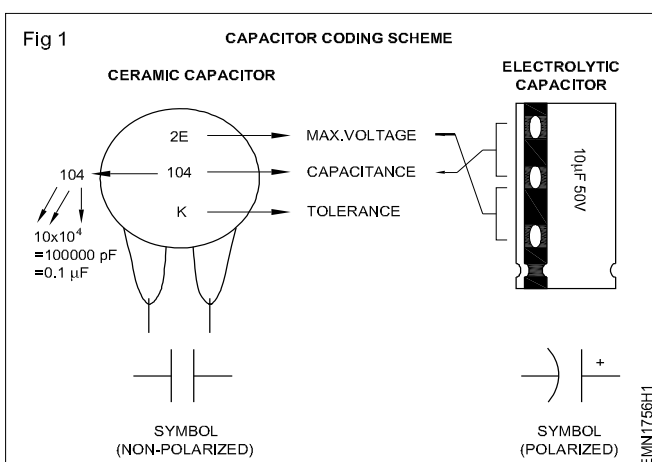
Capacitor Conversion Values

Microfarads (μF)		Nanofarads (nF)		Picofarads (pF)
0.000001 μF	↔	0.001 nF	↔	1 pF
0.00001 μF	↔	0.01 nF	↔	10 pF
0.0001 μF	↔	0.1 nF	↔	100 pF
0.001 μF	↔	1 nF	↔	1,000 pF
0.01 μF	↔	10 nF	↔	10,000 pF
0.1 μF	↔	100 nF	↔	100,000 pF
1 μF	↔	1,000 nF	↔	1,000,000 pF
10 μF	↔	10,000 nF	↔	10,000,000 pF
100 μF	↔	100,000 nF	↔	100,000,000 pF

Max.Operating voltage

Code	Max.Voltage
1H	50V
2A	100V
2T	150V
2D	200V
2E	250V
2G	400V
2J	630V

Tolerance

Code	Percentage
B	±0.1 pF
C	±0.25 pF
D	±0.5 pF
F	±1%

Code	Percentage
G	±2%
H	±3%
J	±5%
K	±10%
M	±20%
Z	±80%, - 20%

92

Identify and test the circuit breaker and other protecting devices

Objectives : At the end of this exercise you shall be able to
• **identify the terminals of Miniature Circuit Breaker (MCB).**
• **connect the MCB in an electrical circuit and check the operation of MCB and ensure its function.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit   - 1 Set
• Digital multimeter with probes   - 1 No
• Electrical Loads   - 5 Nos
• Single Phase Motor/1HP/240V/50Hz   - 1 No
• M.I. Ammeter 0-10A   - 1 No

Materials/Components

• MCB, Single pole, 240V/6A   - 10 Nos
• Connecting wires   - 5 m
• SPST Switch, 240V/15A   - 1 No
• Rheostat, 2500 ohm/10A   - 1 No

PROCEDURE

TASK 1: **Identification of terminals of the MCB**

1 Identify the supply and load terminals of a single pole MCB.

2 Check the continuity between source and load terminals by keeping MCB in OFF position (Should be infinity).

3 Check the continuity between source and load terminals by keeping MCB in ON position (Should be zero).

4 Record the observations in Table-1.

5 Get the work checked by the Instructor.

— — — — — — — —

TASK 2: **Testing of MCB**

1 Collect the miniature circuit breaker and read the specifications of it.

2 Connect the circuit elements as per the circuit diagram shown in figure 1.

MCB TESTING CIRCUIT
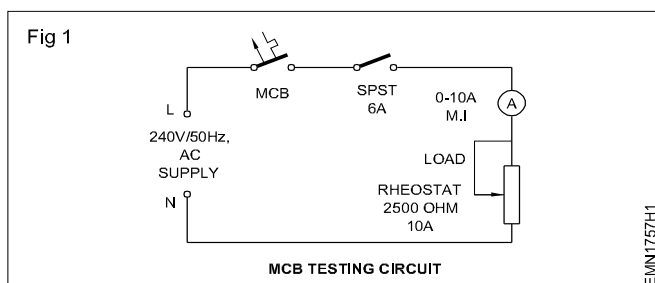
3 Keep Rheostat in maximum position before switching ON supply.

4 Keep the MCB in ON condition and switch ON the mains power supply.

5 Close the SPST switch.

6 Increase the rheostat gradually and note down the readings of the ammeter.

7 Wait for 5 to 10 minutes and note down the status of the MCB in Table-2.

8 Continue the process by increasing the load till the MCB trips.

9 Note down the value of current at which the circuit breaker trips in the circuit.

10 Check whether the MCB trips at 1.3 X In, Where In is the normal rated current of the MCB.

11 Get the work checked by the Instructor.

Note: Instead of Rheostat load, Motor load can also be used for testing the MCB operation.

Specification :
Make   :
Type   :
Current   :
Voltage   :
Short Circuit Current :

Table 1

MCB Position	Continuity Between Source and Load Terminal
OFF	
ON	

MCB trips Current = 1.3 X In = 1.3 X 6 = 7.8 A

** MCB Trips at ___ Amps after ____ Seconds

Table 2

Sl.No	Load current	MCB status
1	0.5 A	
2	1.0 A	
3	2.0 A	
4	5.0 A	
5	6.0 A	
6	8.0A	

— — — — — — — —

93

Dismantle and identify the different parts of a relay

**Objectives :** At the end of this exercise you shall be able to
- **identify the parts of relay and trace the wiring diagram of the relay**
- **test and verify the operation of the Relay.**

Requirements

Tools/Equipments/Instruments

- Trainees Tool Kit   - 1 Set
- Regulated DC Power Supply, 0-30V/2A   - 1 No
- Multimeter/Ohmmeter   - 1 No
- DC Ammeter, 0-1A   - 1 No
- DC Voltmeter, 0-30V   - 1 No

Materials/Components

- Hook-up wire   - 5 m
- 12V Relay   - 1 No

PROCEDURE

TASK 1: **Identification of Relay Parts**

1 Collect the relays along with the instruction booklet. (Refer Fig 1)
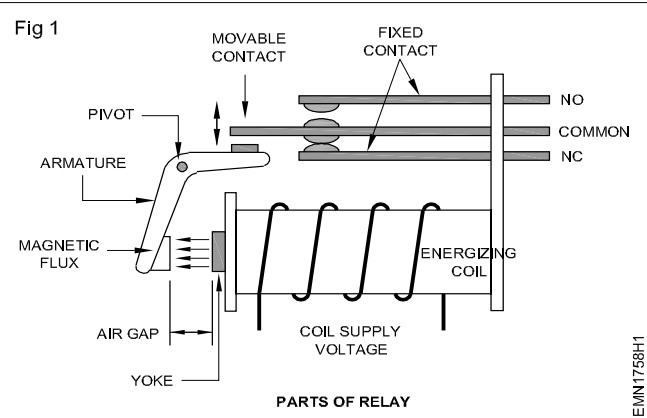
Fig 1

PARTS OF RELAY

2 Inspect and determine the terminal connection of the coil and the number of contacts.

3 Identify the normally open and closed contacts by using Ohmmeter/multimeter.

4 Record the relay and contact terminal number.

5 Draw the connection diagram of the relay in the record.

6 Measure the coil resistance and record.

7 Record all the details in Table 1.

Table 1

1	Type of Relay	: ………….	
2	Coil Voltage	: ………….	
3	Number of terminals	: ………….	
4	Number of NO contact	: ………….	
5	Number of NC contact	: ………….	
6	Coil Resistance	: ………….	Ohm
7	Pickup Current	: ………….	mA
8	Reset Current	: ………….	mA

8 Get the work checked by the Instructor.

— — — — — — — —

TASK 2: **Testing of a Relay**

1 Connect the supply as per the diagram.(Fig 2)

Fig 2
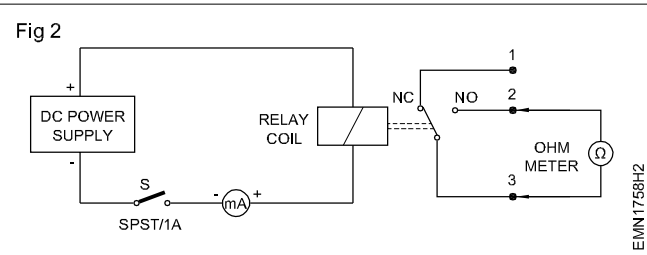
2 Adjust the power supply voltage to minimum.

3 Switch ON the Switch 'S'.

4 Slowly increase the DC Voltage till the ohmmeter/multimeter connected across the normally open contact shows deflection or makes sound.

5 Observe the minimum current (Pick up Current) required to activate the relay and enter the value.

6 Slowly reduce the voltage of the power supply till the ohmmeter/multimeter connected across the normally open contact shows infinity deflection or sound gets OFF.

7 Observe the minimum current (Reset current) required to deactivate the relay and enter the value.

8 Get the work checked by the Instructor.

— — — — — — — —

Connect a timer relay in a circuit and test for its working

Objectives : At the end of this exercise you shall be able to
* **identify the terminals of the timer relay**
* **test and verify the operation of the timer Relay.**

Requirements

Tools/Equipments/Instruments

* Trainees Tool Kit   - 1 Set
* Regulated DC Power Supply, 0-30V/2A   - 1 No
* Multimeter with probes   - 1 No
* Timer Relay 12V DC   - 1 No

Materials/Components

* Hook-up wire   - 5 m
* Bulb, 230V/40W   - 1 No
* Power Cord   - 1 No
* SPST Switch/1A   - 2 Nos

PROCEDURE

TASK 1: **Identification of terminals of the Timer Relay**

1 Collect the timer relays along with the instruction booklet.

2 Inspect and determine the terminal connection of the coil and the number of contacts.

3 Identify the normally open and closed contacts by using Ohmmeter/Multimeter.

4 Record the relay and contact terminal number.

5 Draw the connection diagram of the relay in the record.

6 Measure the coil resistance and record.

7 Get the work checked by the Instructor.
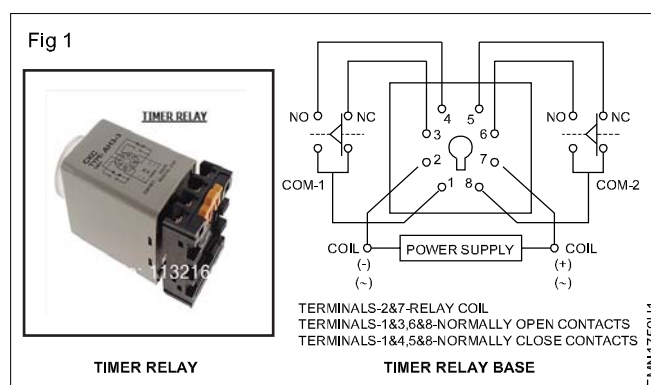

Fig 1

TERMINALS-2&7-RELAY COIL
TERMINALS-1&3,6&8-NORMALLY OPEN CONTACTS
TERMINALS-1&4,5&8-NORMALLY CLOSE CONTACTS

TIMER RELAY   **TIMER RELAY BASE**

— — — — — — — —

TASK 2 **Testing of a Relay**

1 Connect the timer relay control and power circuit connection as per the circuit diagram shown in Fig 2.

Fig 2
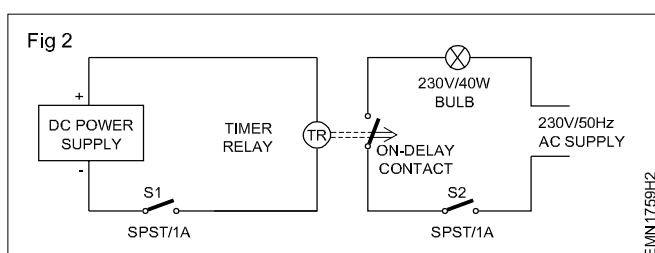
2 Note down the coil supply of the timer relay in the Table-1 and set the DC power supply voltage accordingly.

3 Set the time of the timer relay to 1 minute.

4 Switch ON the SPST Switch 'S1' and check the control circuit operation of the relay.

5 Give 230V/50Hz/AC power supply to the power circuit and Switch ON the SPST switch S2.

6 Note down the delay time in the Table-1 and observe the bulb condition.

7 Get the work checked by the Instructor.

Table 1

Coil Supply	Timer setting	Delay Time Measured

— — — — — — — —

Connect a contactor in a circuit and test for its working

Objectives : At the end of this exercise you shall be able to
• **identify the terminals and auxiliary contacts of the contactor**
• **test and verify the operation of the contactor.**

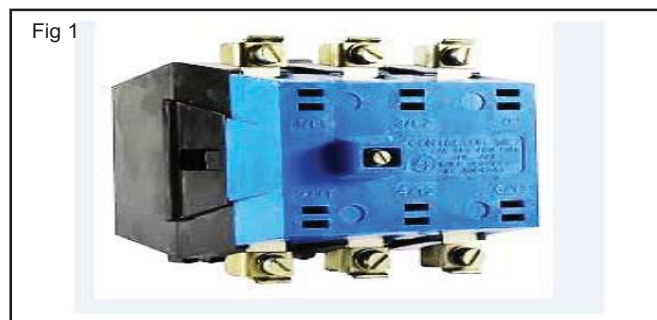| Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit — - 1 Set • Multimeter with probes — - 1 No • Contactor with 2NO/2NC/230V/1A — - 1 No	• 1Sq.mm Multi-strand wire — - 5 m

PROCEDURE

TASK 1: **Identification of terminals auxiliary contacts of the Contactor**

1 Collect the contactor along with the instruction booklet. (Fig 1)

Fig 1

2 Find the main and auxiliary contacts and note down the details in Table-1.

3 Identify the normally open and closed contacts by using Ohmmeter/Multimeter.

4 Record the coil details and its resistance in the Table 1.

5 Get the work checked by the Instructor.

Table 1

Coil supply	Coil Resistance	No.of Main contact	No. of Auxiliary NO contact	No. of Auxiliary NC contact

— — — — — — — —

TASK 2: **Testing of Relay**

1 Make connection to the coil terminal of the contactor.

2 Before energizing the coil, check the continuity of the NO/NC auxiliary contacts and record the observations in the Table-2.

3 Give 230V/50Hz/AC supply to the coil of the contactor and switch ON the supply.

4 Observe the operation of the Contactor.

5 After energizing the coil, check the condition of the NO/NC auxiliary contacts and record the observations in the Table-2.

6 Get the work checked by the Instructor.

Table 2

Before Energizing		After Energizing	
Normally Open (NO)	**Normally Close (NC)**	**Normally Open (NO)**	**Normally Close (NC)**

— — — — — — — —

Construct and test RC-time constant circuit

Objectives : At the end of this exercise you shall be able to
• **construct a RC time constant circuit**
• **measure the charging time delay in RC circuits.**


Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit	- 1 Set
• Digital LCR Meter with manual	- 1 No
• Multimeter with probes	- 1 No
• Dual Trace Oscilloscope, 0-20MHz with manual	- 1 No
• Function Generator with manual	- 1 No

Materials/Components

• Lug Board	- 1 No
• Capacitor, 0.1µF/16V	- 1 No
• Resistor, 10kΩ/¼ CR 25	- 1 No
• Patch Cords	- 10 Nos

PROCEDURE

1   Connect the test set-up as shown in Fig 1.

Fig 1
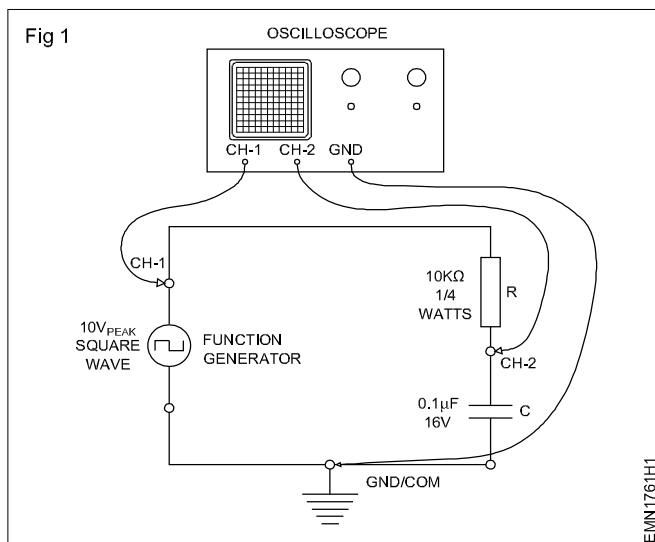
2   Measure and record the values of Resistor and Capacitor in Table-1.

3   Calculate the RC Time constant, (τ=RC seconds) of the circuit and record in Table-1.

4   Set the output of function generator to square wave with a pulse time t_p equal to 6m second (6τ). Set the function generator level to $10V_{P-P}$. Record the set voltage in Table-1.

5   Switch ON CRO. Set CH-1 and CH-2 Time/Div of CRO to 1mS and position the two wave-forms as shown in figure. Adjust the Volts/Div of CRO such that both the waveforms are clearly seen on the screen.

6   Find out the Time constant τ in the charging curve at 63.2% of the input voltage.

7   Compare the practical value with calculated value of τ.

8   Get the work checked by the Instructor.

•   Maximum Capacitor Charging Voltage = ……………Volt

•   63.2% of Capacitor Voltage = ………………Volt.

Table 1

Value of Resistor in Ohm	Value of Capacitor in µF	Time Constant τ = RC	Practical Time Constant τ	Difference

— — — — — — — —

Construct a RC differentiator circuit and convert triangular wave into square wave

Objectives : At the end of this exercise you shall be able to
• **identify the components to the given circuit**
• **test the RC differentiator circuit**
• **record the out put wave form and plot a graph.**

Requirements			
Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Breadboard	- 1 No
• CRO dual trace 0-20 MHz	- 1 No	• Resistor 1.5 kΩ, ¼ W/CR 25	- 2 Nos
• Signal generator	- 1 No	• Capacitor 10 nF	- 2 Nos

PROCEDURE

TASK 1 : **Testing of RC differentiator circuit**

1 Check the given breadboard.

2 Check the components by using mutimeter.

3 Assemble the components as per circuit diagram. (Fig 1)

4 Prepare the CRO and connect the CRO in the circuit.

5 Give the input signal as triangular wave from signal generator and observe the output as square wave.

6 Record the output wave form and plot a graph of input voltage VS time.

Fig 1

Fig 2
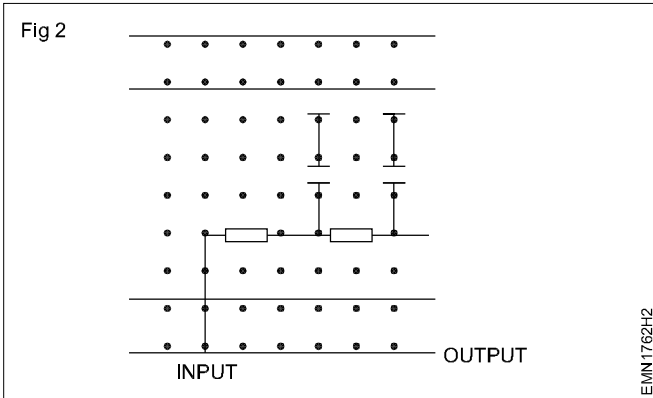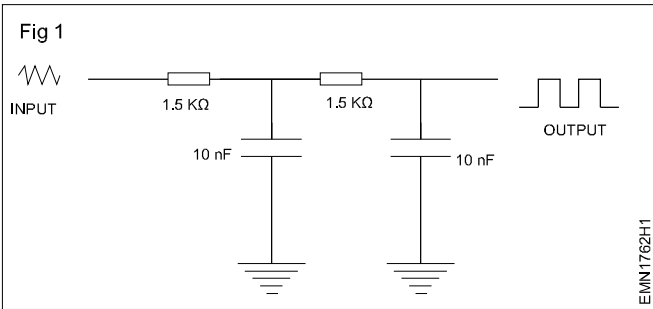
Note : The out wave form depends on the ratio of the pulse width to the RC time constant. when RC is much larger (greater than 10 RC) than the pulse width the output waveform resembles the square wave of the input signal. When RC is much smaller (less than 0.1 RC) than the pulse width, the output waveform takes the form of very sharp and narrow spikes as shown above.

So by varying the time constant of the circuit from 10 RC to 0.1 RC produce a range of different wave shapes.

Generally a smaller time constant.

Fig 3
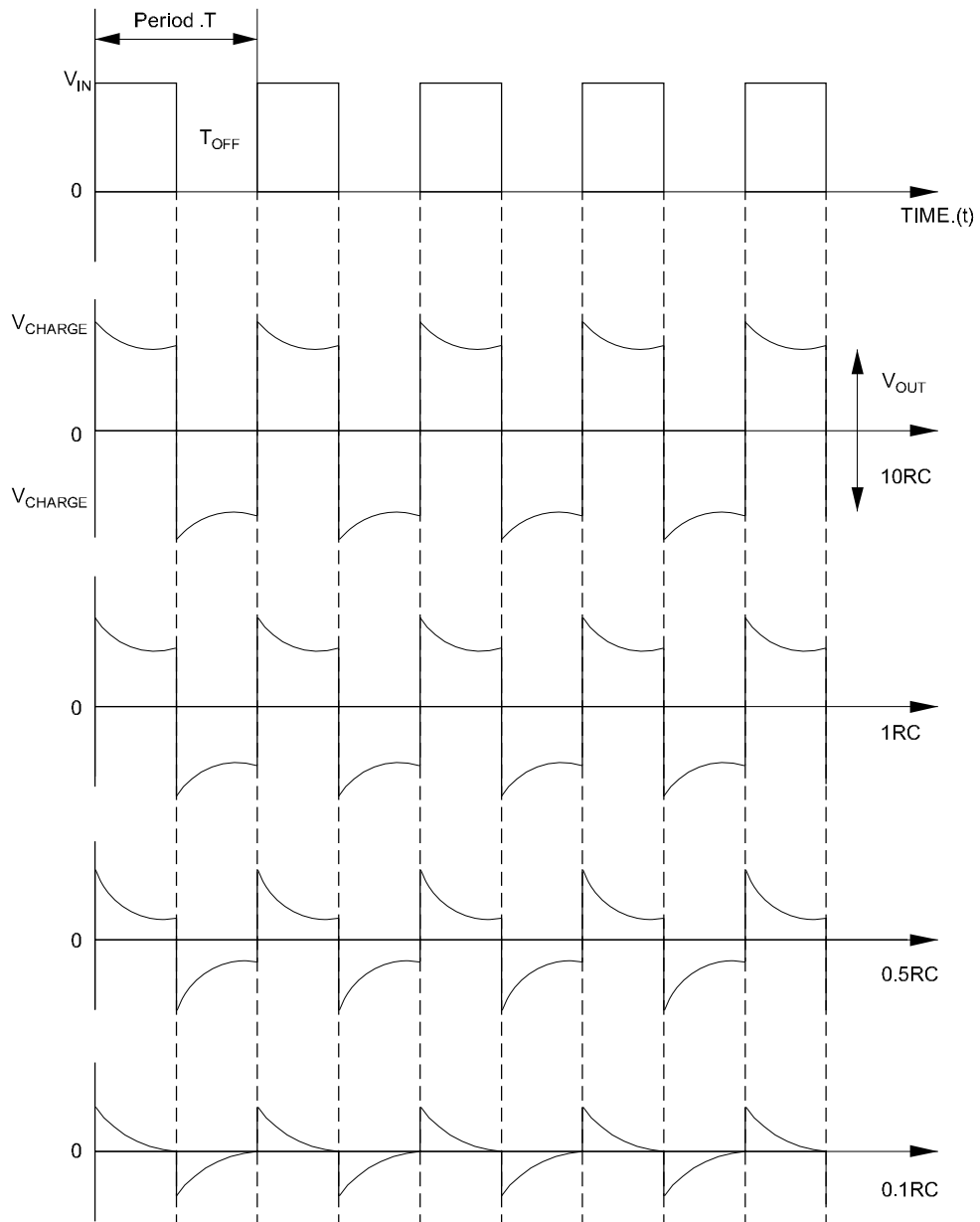
INPUT AND OUTPUT WAVE FORM OF RC DIFFERENTIATOR

EMN1762H3

Construct and test series and parallel resonance circuit

Objectives : At the end of this exercise you shall be able to
• **determine the resonance frequency of a given LC series circuit**
• **determine the circuit current at different frequencies**
• **plot a graph of frequency versus circuit current.**
• **determine the resonance frequency of a given LC parallel circuit.**

Requirements

| Tools/ Equipment/ Instruments		Materials/ Components	
• Trainees tool kit	- 1 Set	• General purpose Lug board	- 1 No
• Dual trace CRO, 0-20 MHz		• Capacitor 0.1 µF	- 1 No
with manual	- 1 No	• Inductor coil, around 40mH (Use	
• Function generator with manual	- 1 No	the solenoid coil made in unit 5)	- 1 No
• Milli Ammeter 0-30mA	- 1 No	• Unknown value Inductor	- 1 No
		• LED with holder	- 1 No
		• Hook-up wires	- as reqd

PROCEDURE

TASK 1 : **Determine the resonance frequency of a given LC series circuit**

1   Measure and record the inductance of the coil.

2   Solder the components as shown Fig 1 to obtain a simple series resonance circuit. Connect instruments as shown in Fig 1

> **The LED in the circuit is to get a visual indication of the current through the circuit at different frequencies.**

Fig 1
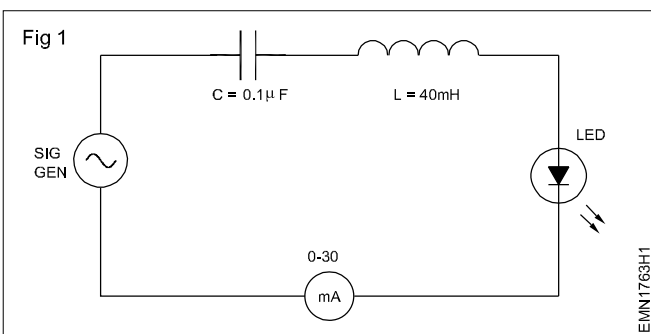
3   Knowing the values of L and C, calculate and record the resonance frequency of the series resonance circuit.

4   Set the output of the signal generator to $10V_{rms}$ and frequency to 1 kHz. Record the current, I through the circuit.

> **LED may not be glow or may be very dim, because the set frequency of 1 kHz may not be the resonance frequency of the circuit.**

5   Increase the frequency gradually and record the resonance frequency for at which the circuit current becomes maximum (LED glows brightly)

> **This is the resonance frequency of the series resonance circuit because at series resonance current I through the LC circuit will be maximum.**

6   Compare and record the difference in the resonance frequency calculated at step 3 and that measured in step 5.

7   Vary the input frequency in steps of 500 Hz around the resonance frequency and in each step record the value of circuit current.

8   From the recorded readings of current in step 6, plot a graph of frequency versus current and mark the resonance frequency of the LC series circuit.

9   Get the working of the circuit, recorded readings and the graph checked by the instructor.

— — — — — — — —

TASK 2 : **Determine the resonance frequency of a given LC parallel circuit**

1 Measure and record the inductance of the coil.

2 Solder the component as shown Fig 2 to obtain a simple parallel resonance circuit. Connect components as shown in Fig 2.

> **The LED in the circuit is to get a visual indication of the current through the circuit at different frequencies.**

Fig 2

3 Knowing the values of L and C, calculate and record the resonance frequency of the parallel resonance circuit.

4 Set the output of the signal generator to $4V_{rms}$ and frequency to 1 kHz. Record the current I through the circuit.

> **Ensure that the current through the circuit is around 10 to 12 mA and not more. If more current is flowing, reduce the output level of the signal generator. LED will glow at all frequencies other than at the resonant frequency.**

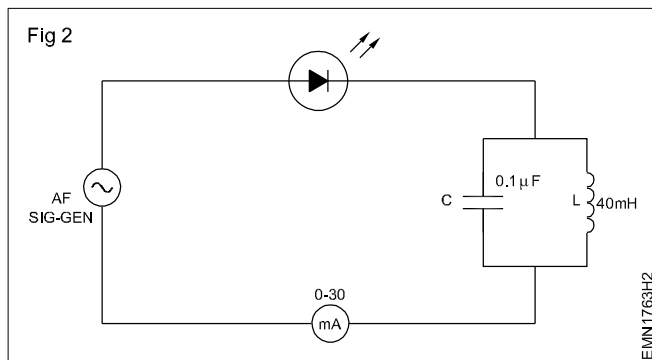5 Increase the frequency gradually and record the resonance frequency f at which the circuit current becomes minimum (LED does not glows or glows very dim).

> **This is the resonance frequency of the parallel resonance circuit because at parallel resonance, current (I) through the parallel LC circuit will be minimum.**

6 Compare and record the difference in the resonance frequency calculated at step 3 and that measured in step 5.

7 Vary the input frequency in steps of 500 Hz around the resonance frequency and in each step record the value of circuit current.

8 From the recorded readings of current in step 6, plot a graph of frequency verses current and mark the resonance frequency of the LC parallel circuit.

9 Get the working of the circuit, recorded readings and the graph checked by the instructor.

— — — — — — — —

Identify different types of diode, diodes, modules and their specifications

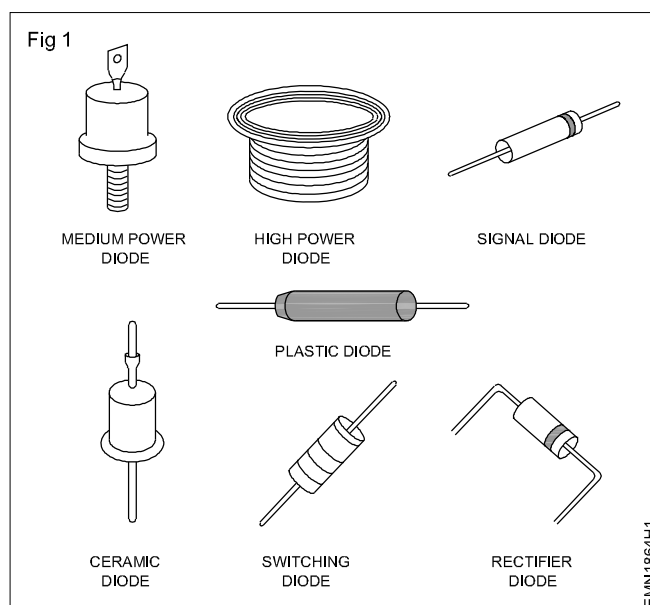**Objectives :** At the end of this exercise you shall be able to
• **identify the diode type, module and specification.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Trainees Tool Kit	- 1 Set	• Assorted type of Diodes	- 10 Nos
• Semi conductor diode data book/ manual	- 1 No		

PROCEDURE

The instructor has to label the different types of Diodes used for this exercise.

1 Pick one of the labelled diode from the given assorted lot.

2 Observe the code number printed on the diode and record in the Table-1.

3 For chosen diode, refer semiconductor data book/ manual and identify the type of diode, semiconductor material type of package.

4 Also record the maximum Forward Current, I_f, peak Inverse Voltage, PIV, forward Voltage Drop, V_f.

5 Repeat step-2 to 4 for all the remaining diodes, and record it in Table 1.

6 Get the work checked by the Instructor.

Fig 1

MEDIUM POWER DIODE · HIGH POWER DIODE · SIGNAL DIODE · PLASTIC DIODE · CERAMIC DIODE · SWITCHING DIODE · RECTIFIER DIODE

Table 1

Label No.	Code No.of Diode	Type of Diode	Semiconductor Material	Type of Package	Maximum Forward Current I_f	Peak Inverse Voltage PIV	Forward Voltage Drop V_f
1							
2							
3							
4							

— — — — — — — —

Test the given diode using multimeter and determine forward to reverse resistance ratio

Objectives : At the end of this exercise you shall be able to
• **test the diode using multimeter**
• **determine the forward to reverse resistance ratio.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees Tool Kit - 1 Set • Multimeter with probes - 1 No • Semi conductor data manual - 1 No	• Assorted type of Diodes - 10 Nos • Red colour Sleeve Wire - 1 No • Patch Cords - 10 Nos

PROCEDURE

The instructor has to label the different types of diodes used for this exercise.

1 Pick one of the labelled diode from the given assorted lot.

2 Set the multimeter to x100Ω range. Carry out resistance zero setting of the meter.

3 Connect the multimeter probes across the diode terminals as shown in the Fig 1a. Record the resistance reading shown by the meter in Table-1.

Fig 1

FORWARD BIAS / REVERSE BIAS
A K / K A
LOW RESISTANCE / HIGH RESISTANCE
DIODE TESTING USING ANALOG MULTI-METER

4 Reverse the meter probe connected to the diode as shown in the Fig 1b and record the reading shown by the meter in Table-1.

5 From the readings noted in step-3 and step-4 calculate and record the ratio between Forward resistance (R_F) to Reverse resistance (R_R).

6 From the recorded information given conclusion of diode.

   • In good diodes, resistance will be less than 100Ω in one direction and very high or almost infinity/open in the other direction.

   • In most cases the ratio between low to high resistance would be at 1:1000.

   • If get zero both ways, the diode is shorted.

   • If get INFINITY both ways, the diode is open.

7 Repeat step-3 to step-6 for all the remaining diodes, and record in Table 1.

8 Get the work checked by the Instructor.

Table 1
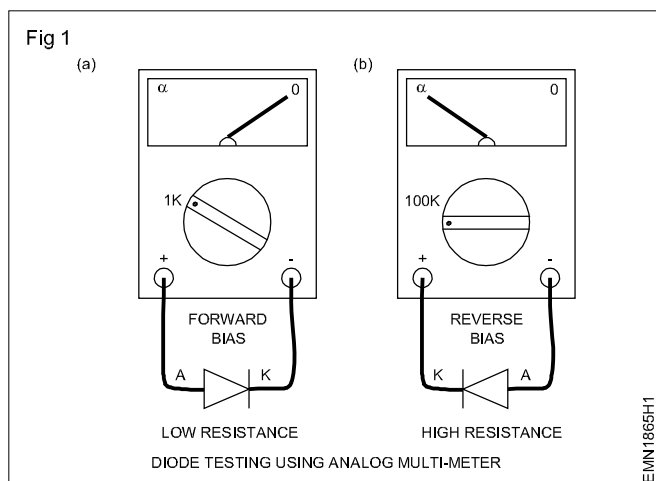
Label No.	Code No.of Diode	Forward Resistance (F_R)	Reverse Resistance (R_R)	Ratio of F_R/R_R	Servicable/ UnServicable
1					
2					
3					
4					

— — — — — — — —

Measure the voltage and current through a diode in a circuit and verify its forward characteristics

Objectives : At the end of this exercise you shall be able to
• **find and plot the forward characteristics of a diode.**

Requirements

Tools/Equipments/Instruments

- Trainees Tool Kit   - 1 Set
- Regulated DC power supply, 0-30V/2A   - 1 No
- DC milli-ammeter, 0-500mA   - 1 No
- DC milli-Voltmeter, 0-1000mV   - 1 No
- DMM with probes   - 1 No

Materials/Components

- Lugboard   - 1 No
- Semiconductor diode, 1N4007 or
  BY127   - 1 No
- Resistor, 470Ω/½ watt CR25   - 1 No
- Hook up Wire   - 2 m
- Patch Cords   - 10 Nos

PROCEDURE

1 Check to confirm the good physical and electrical working condition of the given diode.

2 Identify the Anode and Cathode terminals of the diode.

3 Construct the circuit as shown in Fig 1.

Fig 1

4 Switch ON the Regulated Power Supply and increase the output voltage of the RPSU such that the diode drop V_f varies from 0 to 1V in steps as given in Table-1.

5 At each step record the values of I_f.

6 Switch OFF the RPSU. From the recorded values of V_f and I_f, calculate and the forward resistance R_f of the diode.

7 From the recorded readings in Table-1, plot a graph of V_f and I_f.

8 Get the work checked by the Instructor.
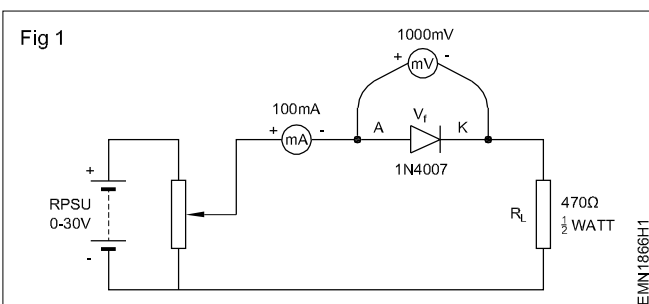
Table 1

- Diode Type Number   :
- Forward Resistance of Diode :
- Reverse Resistance of Diode :
- Lamp Resistance   :

Forward voltage drop across Diode V_f in mV	Forward current I_f in mA	Forward Diode Resistance Ω
100mV		
200mV		
300mV		
400mV		
500mV		
600mV		
700mV		
800mV		
900mV		
1 Volt (1000mV)		

— — — — — — — —

Identify different types of transformers and test

Objectives : At the end of this exercise you shall be able to
• **identify different types of transformer by appearance.**
• **identify different types of transformer by using multimeter.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit   - 1 Set
• Multimeter with probes   - 1 No
• Types of Transformer Chart   - 1 No

Materials/Components

• Assorted type of Transformers   - 10 Nos
• Cotton Waste   - ½ kg

PROCEDURE

The instructor has to label the different types of transformers like, Low voltage step-down transformer, EHT transformer of T V, IFT, Auto transformer.

1 Take one of the labelled transformer from the given lot. Enter its label number in Table-1.

2 For the given transformer, from its appearance, shape of core, etc., identify the type of the transformer, rated voltage and record details in the Table-1.

3 Find the HT and LT winding by measuring resistance with the ohm meter/multimeter/DMM.

4 Draw the symbol of the each transformer in Table-1. Observe the resistance value of windings using multimeter record it in Table 1.

5 Repeat steps-2 to steps-4 for the remaining transformers.

6 Get the work checked by the Instructor.

Table 1

Label No.	Name of the Transformer	Voltage rating		Measured Resistance value		Type/shape of core	Symbol
		H.T	**L.T**	**H.T**	**L.T**		

— — — — — — — —

Identify the primary and secondary windings of transformer and test the polarity

Objectives : At the end of this exercise you shall be able to
• **read and interpret the name plate details of single phase transformer**
• **find out the polarity of the transformer.**

Requirements
Tools/Instruments
• MI Voltmeter 0-300V - 2 Nos   • Ohmmeter 0-500Ω - 1 No   • MI Ammeter 0-10A - 1 No   • MI Ammeter 0-100mA - 1 No   • Push button switch - 1 No   • 12 V battery - 1 No

PROCEDURE

TASK 1 : **Identify the primary and secondary winding of a transformer.**

1 Find out the corresponding terminals and two windings (HT & LT) with ohm meter as shown in Fig 1 by checking the continuity.


Fig 1

2 Determine HT & LT winding by measuring resistances with the ohmmeter.
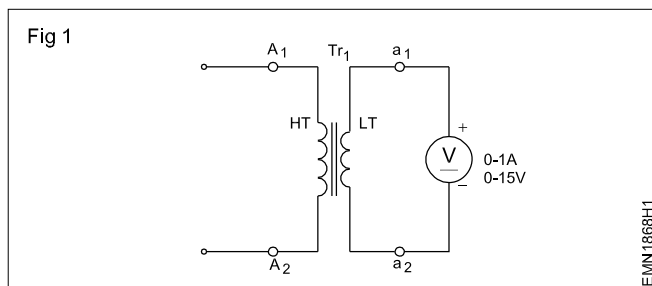
LT windings will have low resistance;mark accordingly.

3 Record resistance of both parts

1st pair -------- ohms. This is HT/LT winding

2nd pair-------ohms. This is HT /LT winding

— — — — — — — —

TASK 2 : **Test the polarity of a transformer**

1 Connect DC supply to HT through push button switch.

2 Connect voltmeter to LT as shown in Fig 2.

Fig 2
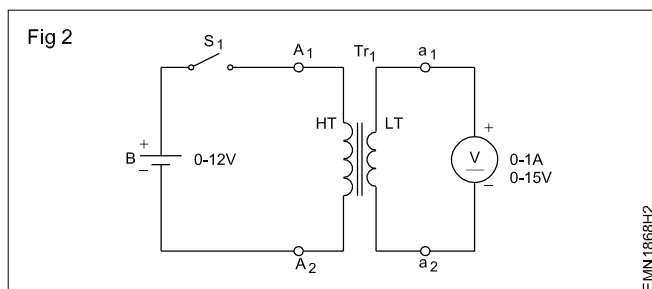
3 Mark HT terminals as A_1 and A_2.

4 Mark LT terminals as a_1 and a_2.

5 Press the push button switch.

6 Observe the deflection of the pointer of the voltmeter. If the pointer deflects in the right direction, retain the markings made on terminals.

7 Change the voltmeter connections made to LT terminals and change the marking made on LT terminals if the deflection is in the reverse direction.

8 Now press the push button switch once again and observe that the voltmeter deflecting in right direction.

— — — — — — — —

Construct and test a Half-wave, Full wave and Bridge rectifier circuit

Objectives: At the end of this exercise you shall be able to
- **construct and test a half-wave rectifier**
- **construct and test a two diode full-wave rectifier**
- **construct and test a full-wave bridge rectifier.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**

• Trainees tool kit	- 1 Set	• Lug Board/PCB	- 1 No
• Oscilloscope 0-30MHz, Dual Trace with probe kit	- 1 No	• Semiconductor diode, 1N4007 or By127	- 4 Nos
• Multimeter with probes	- 1 No	• Step-down Transformer, 230V/12V/500mA	- 1 No
		• Centre tapped Step-down Transformer, 230V/12-0-12V/ 500mA	- 1 No
		• Main cord with Three Pin Plug	- 1 No
		• Resistor, 470Ω/1W CR25	- 1 No
		• Hook up Wire	- 5 m

PROCEDURE

TASK 1 : **Construction and Testing of a Half-Wave rectifier**

1 Check to confirm the good condition of the given components.

2 Using Lug board/PCB, construct the Half-wave rectifier as shown in Fig 1.

3 Connect AC mains to the Transformer and switch ON mains.

4 Measure and record the mains voltage and transformer secondary AC voltage $V_{S(rms)}$ to the rectifier in the Table-1.

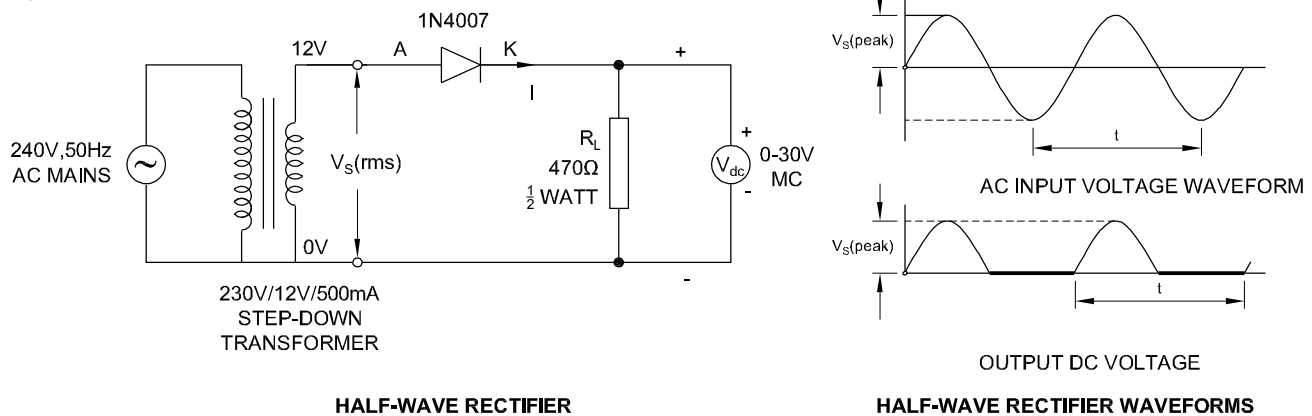5 Calculate the expected DC voltage V_{dc} across the load resistor R_L using the formula,

$V_{dc} = 0.45V_{S(rms)}$

Where, $VS_{(rms)}$ is the AC input to the rectifier.

6 Measure and record the rectifier output DC voltage V_{dc} across R_L using multimeter/Voltmeter.

7 Record the difference in the calculated and measured values.

8 Connect the two channel input probes of the CRO. Set the Volt/div and Time/div of CH-1 and CH-2 such that the two waveforms are seen clearly.

9 From the displayed waveforms on the screen, measure and record the following parameters;

a Peak value of Source Voltage V_S (Input Volt to Rectifier).

b Frequency of Source Voltage V_S.

c Peak value of pulsating DC - V_{dc}.

10 Frequency of Pulsating DC - V_{dc}.

11 Get the work checked by the Instructor.

Table 1

- Type of Transformer :
- Rated Primary Voltage :
- Rated Secondary Voltage :

Mains supply voltage	Secondary voltage $V_{S(rms)}$	Calculated V_{dc}	Measured V_{dc}	Difference between (3) and (4)	Peak value V_S	Frequency of V_S	Peak Value of pulsa ting V_{dc}	Frequency of pulsating V_{dc}

Fig 1

240V,50Hz AC MAINS

12V   A   1N4007   K

$V_S(rms)$

0V

230V/12V/500mA STEP-DOWN TRANSFORMER

R_L 470Ω ½ WATT

V_{dc} 0-30V MC

$V_S(peak)$

t

AC INPUT VOLTAGE WAVEFORM

$V_S(peak)$

t

OUTPUT DC VOLTAGE

HALF-WAVE RECTIFIER   **HALF-WAVE RECTIFIER WAVEFORMS**
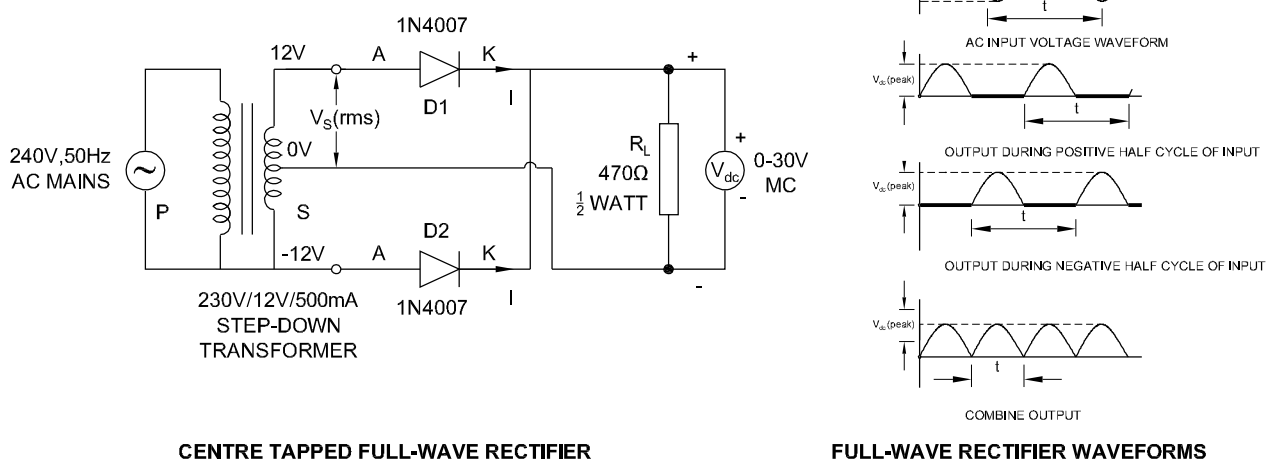
EMN1869H1

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TASK 2: **Construction and Testing of a two diode Full-Wave rectifier**

1   Construct the two diode Full-wave rectifier as shown in Fig 2.

2   Connect AC mains to the centre tapped Transformer and switch ON mains.

3   Measure and record the mains voltage and transformer secondary AC voltage $V_{S(rms)}$ to the rectifier in the Table-2.

4   Calculate the expected DC voltage V_{dc} across the load resistor R_L using the formula,

   $V_{dc}=0.9V_{S(rms)}$

Where, $V_{S(rms)}$ is the AC input to the rectifier.

5   Measure and record the rectifier output DC voltage V_{dc} across R_L using multimeter/Voltmeter.

6   Record the difference in the calculated and measured values.

7   Connect the two channel input probes of the CRO. Set the Volt/div and Time/div of CH-1 and CH-2 such that the two waveforms are seen clearly.

8   From the displayed waveforms on the screen, measure and record peak value of Source Voltage V_S (Input Volt to Rectifier), frequency of Source, Voltage V_S, peak value of pulsating DC - V_{dc}, frequency of Pulsating DC - V_{dc}.

9   Get the work checked by the Instructor.

Fig 2

240V,50Hz AC MAINS

P

12V   A   1N4007   K   D1

$V_S(rms)$

0V

S

-12V   A   K   D2

1N4007

230V/12V/500mA STEP-DOWN TRANSFORMER

R_L 470Ω ½ WATT

V_{dc} 0-30V MC

$V_s(peak)$

t

AC INPUT VOLTAGE WAVEFORM

$V_{dc}(peak)$

t

OUTPUT DURING POSITIVE HALF CYCLE OF INPUT

$V_{dc}(peak)$

t

OUTPUT DURING NEGATIVE HALF CYCLE OF INPUT

$V_{dc}(peak)$

t

COMBINE OUTPUT

CENTRE TAPPED FULL-WAVE RECTIFIER   **FULL-WAVE RECTIFIER WAVEFORMS**

EMN1869H2

Table 2

- Type of Transformer :
- Rated Primary Voltage :
- Rated Secondary Voltage :

Mains supply voltage	Secondary voltage $V_{S(rms)}$	Calculated V_{dc}	Measured V_{dc}	Difference between (3) and (4)	Peak value V_S	Frequency of V_S	Peak Value of pulsating V_{dc}	Frequency of pulsating V_{dc}

TASK 3: **Construction and Testing of four diode full wave bridge rectifier**

1 Construct the Full-wave Bridge rectifier as shown in Fig 3.

2 Connect AC mains to the Transformer and switch ON mains.

3 Measure and record the mains voltage and transformer secondary AC voltage $V_{S(rms)}$ to the rectifier in the Table-3.

4 Calculate the expected DC voltage Vdc across the load resistor RL using the formula,

$V_{dc} = 0.9 V_{S(rms)}$

Where, $V_{S(rms)}$ is the AC input to the rectifier.

5 Measure and record the rectifier output DC voltage V_{dc} across R_L using multi-meter/Voltmeter.

6 Record the difference in the calculated and measured values.

7 Connect the two channel input probes of the CRO. Set the Volt/div and Time/div of CH-1 and CH-2 such that the two waveforms are seen clearly.

8 From the displayed waveforms on the screen, measure and record the following parameters;

- Peak value of Source Voltage V_S (Input Volt to Rectifier).

- Frequency of Source Voltage V_S.

- Peak value of pulsating DC - V_{dc}.

- Frequency of Pulsating DC - V_{dc}.
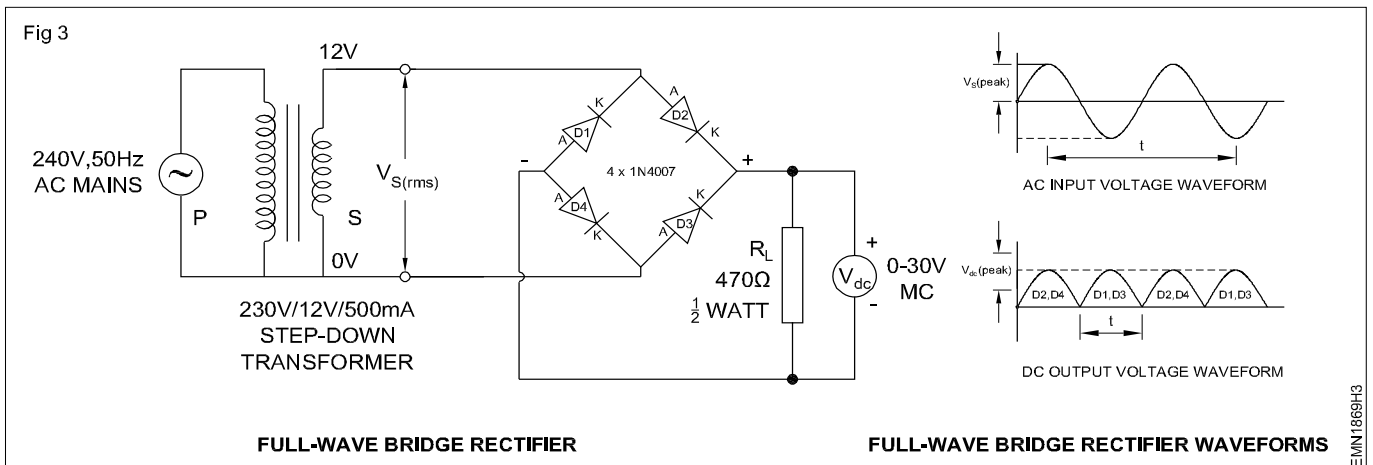
9 Get the work checked by the Instructor

Fig 3

FULL-WAVE BRIDGE RECTIFIER   FULL-WAVE BRIDGE RECTIFIER WAVEFORMS

Table 3

- Type of Transformer :
- Rated Primary Voltage :
- Rated Secondary Voltage :

Mains supply voltage	Secondary voltage $V_{S(rms)}$	Calculated V_{dc}	Measured V_{dc}	Difference between (3) and (4)	Peak value V_S	Frequency of V_S	Peak Value of pulsating V_{dc}	Frequency of pulsating V_{dc}

Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors

Objectives: At the end of this exercise you shall be able to
• **construct and test the effect of capacitor filter with different load condition**
• **determine the ripple voltage, ripple frequency and ripple factor.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Oscilloscope Dual Trace 0-20 MHz	- 1 No
• Multimeter with probes	- 1 No
• Voltmeter, 0-30V, MC	- 1 No

Materials/Components

• Lugboard/PCB	- 1 No
• Semiconductor diode, 1N4007 or By127	- 4 Nos
• Step-down Transformer, 12V/500mA	- 1 No
• Mains cord with Three Pin Plug	- 1 No
• Resistor, 5Ω /½W	- 1 No
• Resistor, 470Ω/1W	- 1 No
• Electrolytic Capacitor, 1000µF/25V	- 2 Nos
• SPST switch/1A	- 5 Nos
• Hook up wire	- 5 m
• Patch cords	- 10 Nos

PROCEDURE

1 Collect and check the required components.

2 Connect the components as shown in Fig 1.

3 Energize the input to the transformer with 230V AC.

4 Observe the output waveform on CRO and measure the output with switch S_1, S_3 open and S_2, S_4 closed under full-wave rectifier.

5 With switch S_1, S_2, S_4 "ON" and S3 "OFF" the circuit acts as capacitor input filter. Observe the output waveform on the CRO and plot it.

6 Switch "OFF" S_2 and switch "ON" S_1, S_3, S_4, the circuit becomes full-wave rectifier with filter. Observe the output voltage wave shape on CRO and plot it.

7 Measure the output voltage ($V_{r(p-p)}$) as well as DC.

8 Calculate the Ripple factor for all the three conditions.

9 Get the work checked by the Instructor.

Fig 1
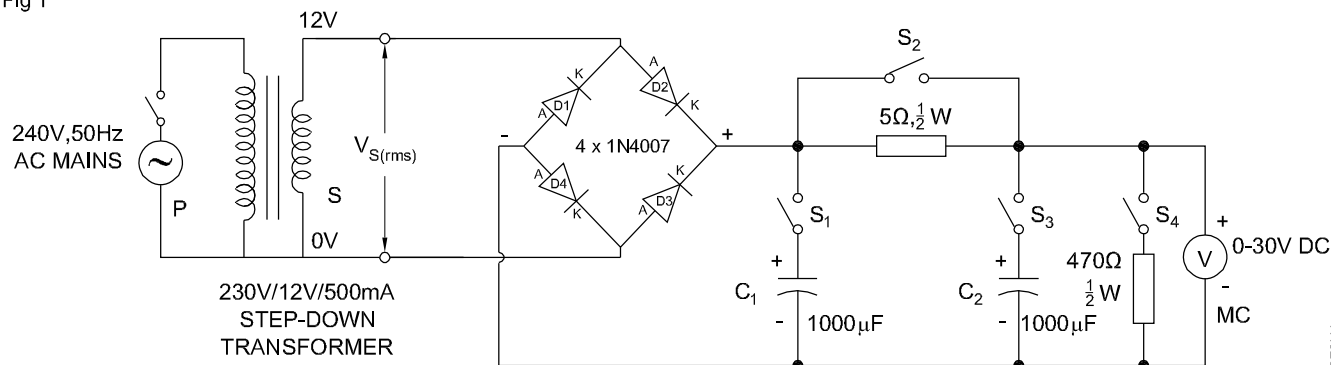
Identify and test zener diode

Objectives : At the end of this exercise you shall be able to
• **identify and test the Zener Diodes.**

Requirements

Tools/Equipments/Instruments

• Trainees Tool Kit   - 1 Set
• Multimeter with probes   - 1 No
• Semi conductor data manual   - 1 No

Materials/Components

• Assorted type of zener diodes   - 1 No
           each

PROCEDURE

> **The instructor has to label the different types of zener diodes used for this exercise.**

1 Pick one of the labelled Zener diode from the given lot.

2 Record the code number printed on the Zener diode in the Table-1.

3 For chosen Zener diode, refer semiconductor data book and identify the following.

• Zener Voltage, V_Z

• Maximum Zener Current, I_Z

• Maximum Power dissipation, P_Z and record in the table.

4 Connect the multimeter probes across the Zener diode terminals as shown in the figure -1a. Measure and record the resistance value shown by the meter in Table-1.

5 Reverse the meter probe connected to the Zener diode as shown in the figure- 1b measure and resistance record the value shown by the meter in Table-1.

6 From the recorded information given conclusion of Zener diode.

• In good Zener diodes, resistance will be less than 100Ω in one direction and very high or almost infinity/open in the other direction.

• If you get zero both ways, the diode is shorted.

• If you get INFINITY both ways, the diode is open.

7 Repeat step-2 to step-6 for all the remaining Zener diodes.
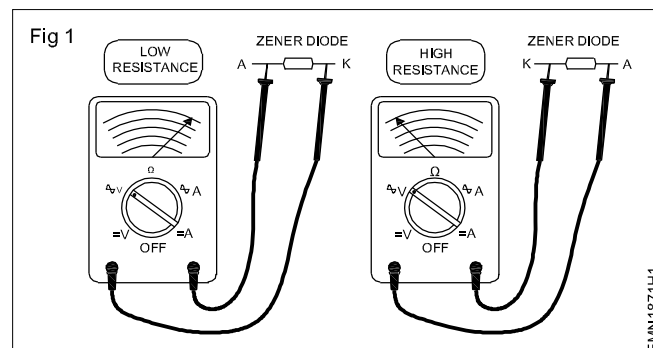
8 Get the work checked by the Instructor.

Fig 1

Table 1

Label No	Code No. of Diode	Zender Voltage V_Z	Maximum Zener Current, I_Z	Maximum Power Dissipation, P_Z	Forward Resistance F_R	Reverse Resistance R_R	Remarks
1							
2							
3							

— — — — — — — —

## Construct and test zener diode based voltage regulator circuit

Objectives: At the end of this exercise you shall be able to
• **construct and test the Zener based voltage regulator circuit**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Regulated DC power Supply 0-30V/2A	- 1 No
• Multimeter with probes	- 1 No
• Ammeter, 0-300mA MC	- 1 No
• Voltmeter, 0-30V, MC	- 2 Nos
• Voltmeter, 0-10V, MC	- 1 No

Materials/Components

• Lug Board/PCB	- 1 No
• Zener Diode, 5.6V	- 1 No
• Resistor, 470Ω/½W	- 1 No
• Hook up wire	- 3 m
• Patch cords	- 10 Nos

PROCEDURE

1 Collect the equipments and components and check the items for its good working condition.

2 Connect them as in the circuit diagram-1.

Fig 1

3 Switch ON the input supply.

4 Measure and record the values of V_R, V_Z and I_Z in the Table-1.

5 After observing readings, switch "OFF" PSU and from the recorded readings, calculate the Zener resistance R_Z and power dissipated P_Z for each set of readings.

6 Get the work checked by the Instructor.
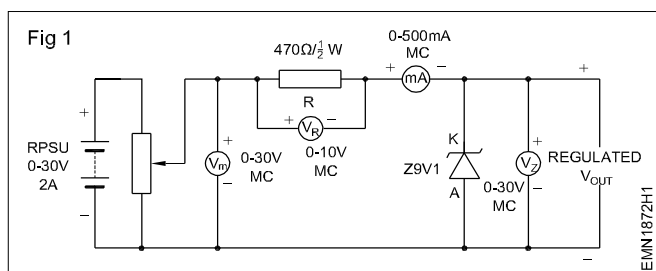
> **Do not dismantle the circuit board as this is to be utilized for exercise No.1.8.73**

Table 1

Sl. No.	Unregulated Input voltage, V_{in}	Voltage Drop across series Resistor V_R	Zener voltage V_Z	Zener current, I_Z	Calculated	
					Zener Resistance, R_Z	Zener Power, P_Z

Formula:

• Zener Resistance = $R_z = \dfrac{V_z}{I_z}$

• Zener Power = $P_z = V_z . I_z$

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Calculate the percentage regulation of regulated power supply

Objectives: At the end of this exercise you shall be able to
• **construct test and calculate the percentage regulation of regulated power supply.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Power Supply Unit, 0-30V/1A	- 1 No
• Multimeter with probes	- 1 No
• Ammeter, 0-300mA MC	- 1 No
• Voltmeter, 0-30V, MC	- 2 Nos
• Voltmeter, 0-10V, MC	- 1 No

Materials/Components

• Lug Board/PCB	- 1 No
• Zener Diode, 5.6V	- 1 No
• Resistor, 4.7kΩ/1/2W	- 1 No
• Resistor, 3.3kΩ/1/2W	- 1 No
• Resistor, 2.2kΩ/1/2W	- 1 No
• Resistor, 1kΩ/1/2W	- 1 No
• Resistor, 470Ω/1/2W	- 1 No
• Hook up wire	- 3 m
• Patch cords	- 10 Nos

PROCEDURE

1 Use the assembled circuit diagram of exercise-1.8.72, for this task.

2 Switch "ON" PSU, set input voltage (V_{in}) to 15V.

3 Measure and record the no load voltage V_{out}.

4 Connect load resistor of values given in the Table-2 across the output terminals and in each case measure and record load current I_L and output voltage V_{out}.

Fig 1

5 Calculate and record the output percentage of load regulation at different loads using the formula,

$$\text{\% of Load Regulation} = \frac{V_{NL} - V_L}{V_{NL}} \times 100$$

Where, V_{NL} - V_{out} at no-load

V_L - V_{out} at load

6 Get the work checked by the Instructor.
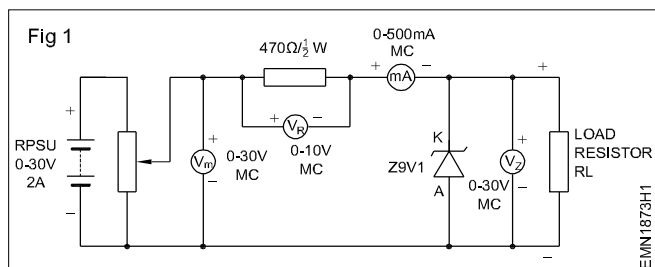
Table 1

V_{IN} at 10 Volts Constant			
Load Resistor, R$_L$	**Output Voltage, V$_{OUT}$**	**Load Current, I$_L$**	**% of Load Regulation**
0 Ohms			
2.2kΩ			
3.3kΩ			
4.7kΩ			

Formula:

• Percentage Load Regulation = $\dfrac{V_{NL} - V_L}{V_{NL}} \times 100$

— — — — — — — —

Identify various indicators, cables, connectors and ports on the computer cabinet

Objectives : At the end of this exercise you shall be able to
• **identify various input/output devices connected to the computer**
• **identify different controls and ports on the PC system**
• **identify the internal parts of a system unit**
• **connect devices to related ports on the system unit.**

Requirements
Hardware and software
•   Computer set   - 1 No

TASK 1 : **Identification of different controls, ports and connectors on the PC system**

The instructor has to demonstrate the uses of the following indicators ,switches controls (Fig 1) and ports external to the processor found on the system unit shown in (Fig 2)and the trainees will make a record of it in Table 1 and Table 2.
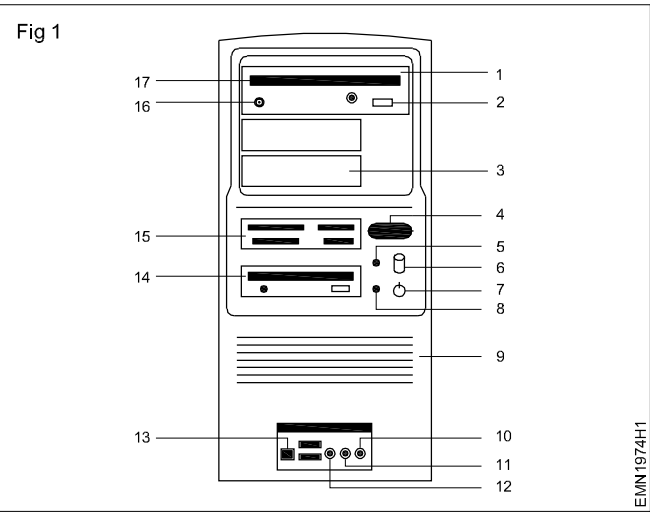
Table 1

Sl. No	Name the parts on the CPU Front Panel
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	

Fig 1

EMN1974H1

Fig 2

EMN1974H2
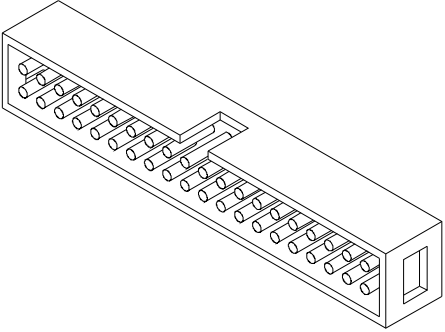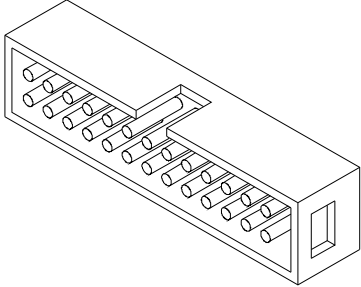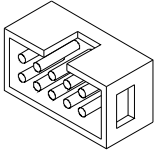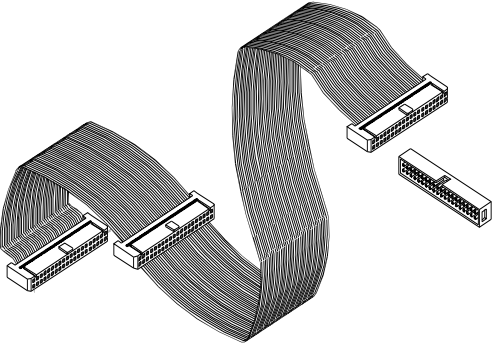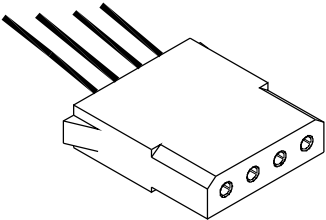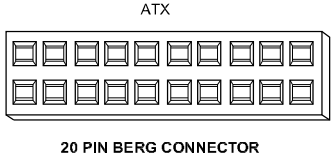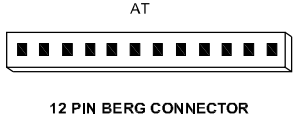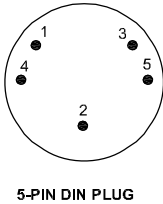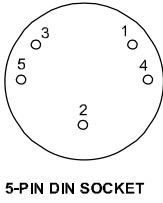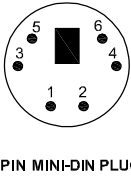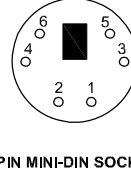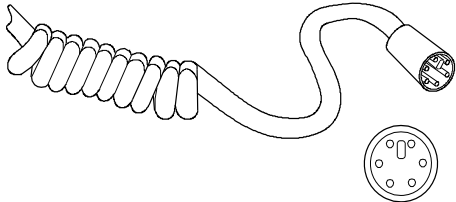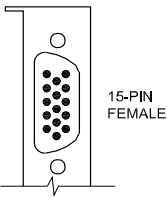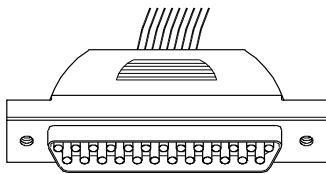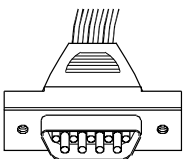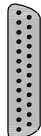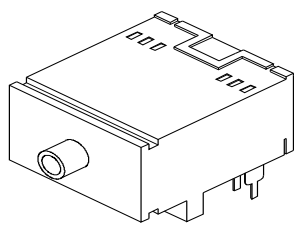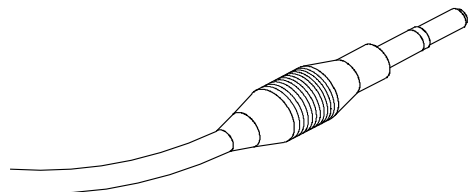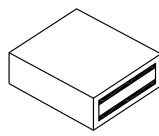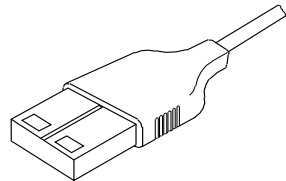
Table 2

Sl. No	Name the ports on the CPU Rear Panel
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Chart 1

Description	Application	Cable/connector
40 pin FRC male connector located on MB	To connect MB with HDD	 **40 PIN FRC CONNECTOR**
25 pin FRC male connector located on MB	To connect MB with Parallel port provided on the rear side of the PC	 **26 PIN FRC CONNECTOR**
10 pin FRC male connector located on MB	To connect MB with serial port "D" connector provided on the rear side of the PC	 **10 PIN FRC CONNECTOR**
HDD cable (data) located inside the PC	To connect MB with HDD	 **HARD DISK CABLE**
4 pin Molex connector from SMPS unit	SMPS to HDD, FDD, CDD	 **MOLEX CONNECTOR**

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.74   **115**

Description	Application	Cable/connector
20 pin Berg connector from SMPS unit	SMPS (ATX) to MB	ATX **20 PIN BERG CONNECTOR**
12 pin Berg connector	SMPS (AT) to MB	AT **12 PIN BERG CONNECTOR**
5 pin DIN plug on key board cable	Key board to MB	 **5-PIN DIN PLUG**
5 pin DIN socket provided on the rear side of the PC	MB to key board	 **5-PIN DIN SOCKET**
5 pin Miniature DIN plug on keyboard cable	Key board to MB	 **5-PIN MINI-DIN PLUG**
5 pin Miniature DIN socket provided on the rear side of the PC	MB to key board	 **6-PIN MINI-DIN SOCKET**
PS/2 Key board connectors	MB to Mouse, Mouse to MB	 **NEW STYLE PS/2 MINI DIN KEYBOARD CONNECTOR WITH SIX PINS**

Description	Application	Cable/connector
15 pin High density VGA connector on the rear side of PC	MB to Monitor	15-PIN FEMALE HIGH DENSITY CONNECTOR
D-25 pin male connector on the rear side of the PC	Serial port (Comport)	25 PIN MALE CONNECTOR
D-9 pin male connector on the rear side of the PC	Serial port (Comport)	9 PIN MALE CONNECTOR
D-25 pin female connector on the rear side of the PC	Parallel port (Printer port)	25-PIN FEMALE CONNECTOR
Mini Jack socket on the rear side of the PC	Audio IN / MIC	MINI JACK SOCKET
Mini Jack from external audio device	External Audio Devices to Sound card	MINI JACK
USB female connector provided on the rear side of the PC	MB to USB peripherals	FEMALE USB CONNECTOR
USB male connector from the USB device	USB peripherals to MB	MALE USB CONNECTOR

Table 3

Sl. No	Name of the Connector/Cable
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Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.74

Demonstrate various parts of the system unit and motherboard components

Objectives : At the end of this exercise you shall be able to
• **identify drives HDD, CD ROM drive, DVD-drive, USB pen drive and various secondary storage devices and their usual maximum capacity for storage of information.**

Requirements

Tools/Instruments

• Screw driver set   - 1 No
• Digital Multimeter   - 1 No

Equipments

• Desktop PC with mouse & keyboard   - 1 No
• Extra SATA and PATA Hard-Disk
  Drive compatible cables   - as reqd

Materials

• Sticking labels for marking
  cables & connectors   - as reqd

• **In PC along with one set of I/O devices will be used for demonstration by instructor**

• **Two PCs each with one set of I/O devices and extra SATA HDD with cable, extra PATA DD with cable and one extra CD ROM drive / DVD ROM drive with cable, will be used by two groups of trainees (each group of maximum 20 trainees one group for identification and other for cable connection).**

• **In the PCs used by trainees ensure that all the major components inside system unit are cabled such that trainees can identify referring wall chart diagram.**

• **All the cables internal to system unit (processing unit) should be labelled along with (From - TO) and male - female connectors are also to be labelled by same code with suffix "F"&"T".**

• **All major components inside the processing unit like - HDD, CD R/W drive, DVD R/W drive, CPU processor, ROM BIOS etc to be labelled.**

• **Before opening the system unit processing unit, static charge of our body should discharge through earthing cable connected to body of demonstrator / user.**

PROCEDURE

TASK 1 : **Identification of various drives and secondary storage devices in a PC**

1 Remove the cover of the PC system unit

2 Observe hard disk drive type either SATA or PATA and its capacity, power connection cable, its voltage column colour code at cable with voltage supply used.

3 Identify desktop PC HDD, CD-R/W drive & DVD - ROM drive, its connections for both type SATA and PATA hard disk drive and its connection using straight cables, cross cable for making it primary master either, primary slave or secondary master / slave using suitable data cable.

4 Identify connection point at mother board for SATA HDD, PATA HDD, CD R/W drive, and DVD R/W used in desktop PC

5 Identify different type cable connections used for different drive.

6 Identify polarity of connector to avoid wrong connection.

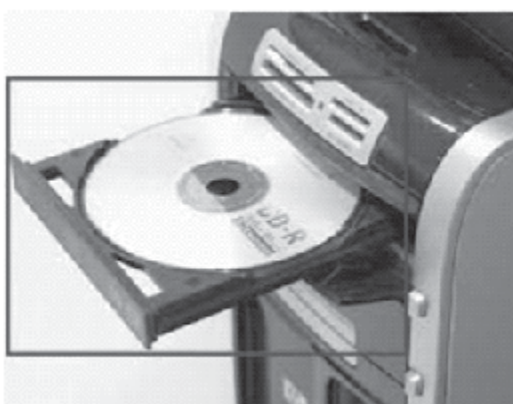7 Fix the cabinet, switch on supply and check the status of computer.

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Fig 1

Floppy Drive

Fig 2

DVD Drive

Fig 3

CD Drive

Fig 4

Hard Disk Drive

Fig 5

Fig 6

Inside of a computer case

CD-ROM   Power cable   Floppy drive   Data cable   Hard disk drive

Motherboard

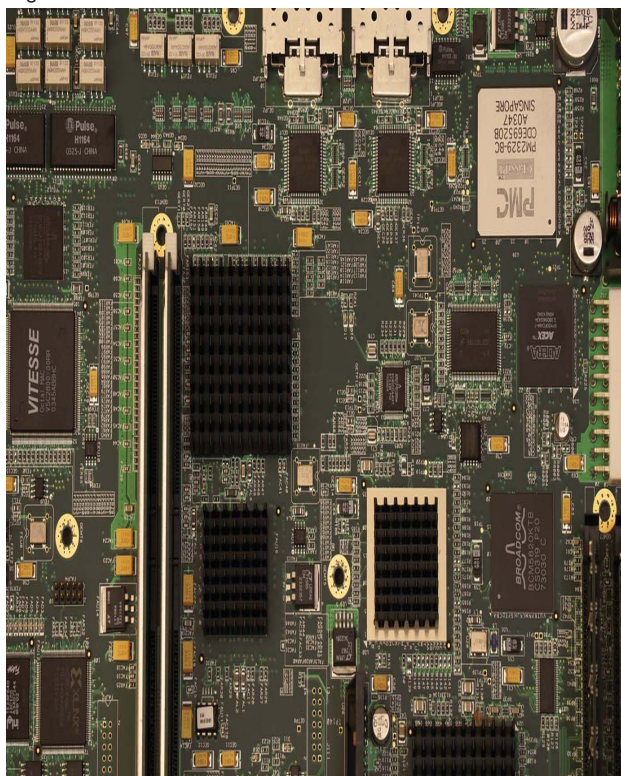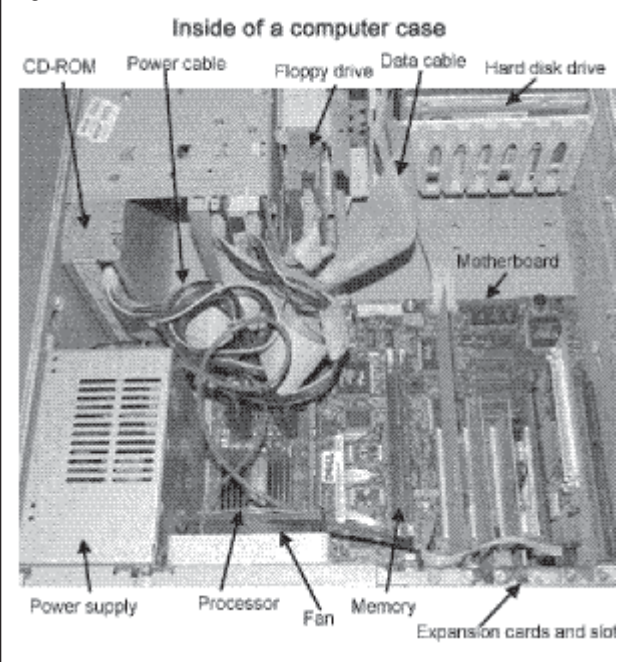Power supply   Processor   Fan   Memory   Expansion cards and slot

Identify various computer peripherals and connect it to the system

Objectives : At the end of this exercise you shall be able to
• **identify different controls on the processing unit cabinet**
• **identify various input/output devices connected to PC**
• **identify various ports available on PC for various devices.**

Requirements

Hardware and software

• Identical PCs with labelled ports,
  connection cables
  (could even be dummy)   - as reqd

• I/O devices such as Keyboard, Mouse
  Monitor, Printer, Multimedia, Speaker,
  CD Drive, DVD Drive and Microphone   - as reqd

• Screw driver set and Allen key
  (depending upon the type of

  fixing used with connectors)   - as reqd
• Sticking labels   - as reqd

• **One PC along with one set of I/O devices will be used for demonstrating by the instructor.**

• **Two PC's each with one set of I/O devices will be used by two groups of trainees(each group not exceeding a maximum of ten trainees)**

PROCEDURE

TASK 1 : **Identify the major components, Controls and Ports seen on the processing unit cabinet**

A. The instructor has to demonstrate the uses of the indicators, switches, controls and Ports external to the processor unit found on the cabinet of the processor unit as per the list given below.

• Mains power-on switch

• Power on LED

• Reset button

• HDD busy LED

• Floppy Disk Drive, Disk eject button, Disk busy LED

• CD Drive, CD busy/reading LED, controls and sockets found on the disk drive

• Ports for connecting the Mouse and other devices

• Printer port, keyboard connector, monitor connector

• Speaker socket

• Universal serial bus port (USB)

While demonstrating, the following points should be Highlighted and stressed.

• Function of each switch

• Function of each LED indicator

• Function of each visible device

• Function of each port

• Basic specification of DVD and CD drive

• Basic symptoms of healthy processor (fan sound, power light, any unusual noise/smell etc)

• Precaution to be taken while using the computer

• Precaution to be taken while operating DVD and CD drives

• Precaution to be taken while handling DVD and CD

• Precaution to be taken while handling and storing the processor unit

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TASK 2 : **Identification of the I/O devices connected to PC**

A. The Instructor has to demonstrate the controls of different I/O devices connected to PC as per the list

- The Monitor
- The Printer
- The Mouse
- The Keyboard
- Multimedia speakers
- The microphone
- The scanner
- The Modem
- Any other I/O devices available at the time of conducting this demonstration.

While carrying out the demonstration, the instructor has to ensure the following points are highlighted,

Precautions to be taken for handling the PC system.

1 Record the I/O devices connected to the computer setup given to you

2 Record the manufacturer, type name and model name/ number of the I/O devices connected

3 Record against each device whether it is an input device or an output device

4 Get the recorded details of the devices checked by the instructor.

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Disable certain functionality by disconnecting the concerned cables SATA / PATA

Objectives : At the end of this exercise you shall be able to
• **disable the functionality from device manager**
• **disconnecting the devices from the mother board.**

Requirements	
Tools/Equipments/Instruments	**Materials/Components**

Tools/Equipments/Instruments

• Trainees tool kit   - 1 Set
• Digital multimeter with probes   - as reqd
• Static charge earthing cable
  system   - as reqd
• Desktop PC with mouse & keyboard   - as reqd
• Extra SATA and PATA Hard-Disk
  Drive compatible cables   - as reqd

Materials/Components

• Sticking labels for marking
  cables & connectors   - as reqd

PROCEDURE

TASK 1: **Disabling the device/port/ USB/from the device manager**

1 Click start menu of windows desktop screen

2 Open control panel in start menu

3 Select and open device manager

4 Now, locate device or port or USB or connector to enable or disable.

5 After finding the device or port or USB or connector, select it and make mouse right click on device icon.

6 Select and open the properties of device in right click menu.

7 In properties window, select the drivers tab

8 Now click the button of disable for disabling the device.

9 Click the OK button on window

10 Now disconnect the concerned device connected to connector

11 Check the worksheet by the instructor

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TASK 2 : **Disconnecting the devices from the motherboard**

1 Open the cabinet of the desktop PC

2 Identify the port or USB cable connections on motherboard by using motherboard diagram.

3 Unlock if any protection screws are present on cable connectors

4 Remove the cable connectors and check the status on desktop.

5 Get the work checked by the Instructor.

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Replace the CMOS battery and extend a memory module

Objectives : At the end of this exercise you shall be able to
- **identify the battery information and type of battery**
- **remove the battery**
- **replace the battery**
- **identify the location of RAM (S1mm/D1mm)**
- **replace and extend the RAM.**

Requirements

Tools/Equipments/Instruments

•	Watch-maker screw driver set	- 1 No
•	Screw driver set	- 1 No
•	Desktop P.C. with mouse and keyboard	- 1 No
•	Extra mother board of computer	- 1 No

Materials/Components

•	Quick guide or manual for motherboard of P.C. showing diagram & its components	- 1 No
•	CMOS battery	- 1 No
•	Different types of RAM suitable to the motherboard	- as reqd
•	Quick installation guide	- 1 No

PROCEDURE

TASK 1 : **Identification of battery and type**

1 Open the chasis/case of computer

2 Find the battery location on motherboard by referring quick guide or manual

3 Find the type of cell (example: Coin Cell) as shown in Fig 1.

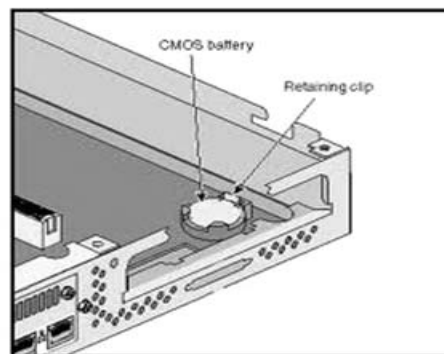4 Note down information available on cell like voltage, size or package etc

Most of the batteries will be like CR2000 etc.

5 Identify type of socket (socket with upper tab, socket with lateral, inside socket laying) provided on battery

6 Get the work checked by the Instructor.

Fig 1

Fig 2

— — — — — — — —

TASK 2 : **Removal of the battery**

1 Remove or side the wires laying on battery.

2 Draw back the tabs surrounded by battery by using small screw driver or watch maker screw driver.

Use suitable watchmaker screw driver for tap screw lock removing.

3 Gently pull the battery and remove the battery as shown in Fig 4.

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Fig 3

Fig 4

1 battery release lever   2 battery (positive side)
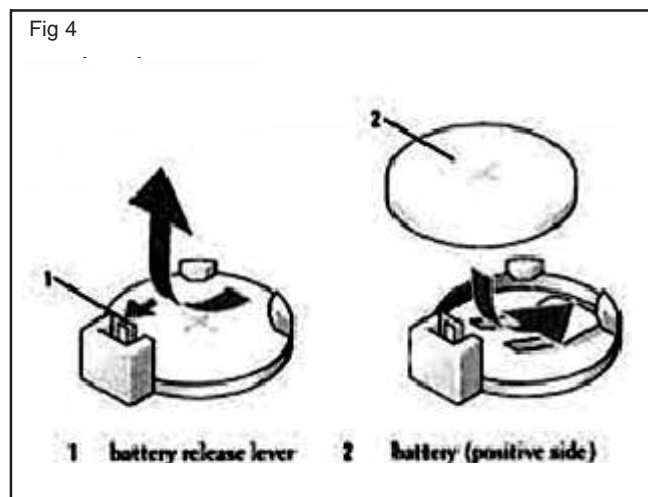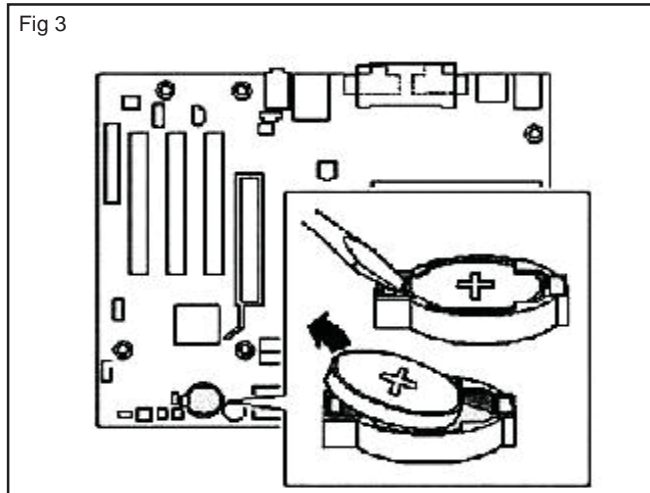
TASK 3 : **Replacing the battery**

1 Identify the polarity of battery by using symbol or indicator.

2 Identify the polarity of socket by using symbol or indicator.

3 Place the battery on the socket and press gently to lock tabs of socket as shown in Fig 5.

4 If it is screw lock tab, hold the lab and make screw the tab.

5 Get the work checked by the Instructor.

Fig 5
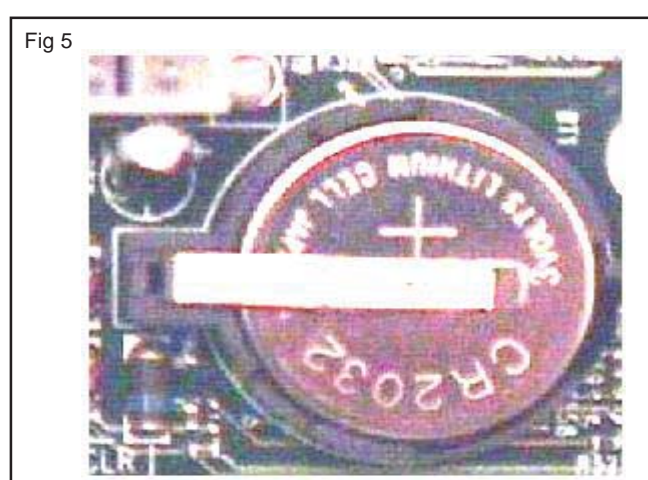
TASK 4 : **Identification of RAM (SIMM/DIMM)**

1 Open cover of computer system unit using four head screw driver.

2 Note the mother board information like type of board, type of RAM (SIMM/DIMM) either it is DDR1 or DDR2 supporting and front system bus speed etc.

3 Find the RAM location on motherboard by referring quick guide or manual.

4 Note the number of RAM slots available on board.

5 Identify the master and slave RAM slots by printed information or by colour or reference manual.

6 Note each RAM slot maximum capacity.

7 Note the RAM slot information like type of RAM supporting and RAM Series (1, 2, 3 etc.).

Some slots are supporting two or more series.

TASK 5: **Replacing and Extending the RAM**

1 Note the fixed RAM information available on board.

2 Observe the RAM lock tabs types available on slots.

3 Identify and note the reference notch point of slot.

4 Open the lock tabs gently.

5 Hold the RAM in the proper direction and matching reference notch as shown in Fig 6.

6 Fix the RAM by pressing gently.

7 Ensure the proper locking of tabs.

Fig 6

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.78

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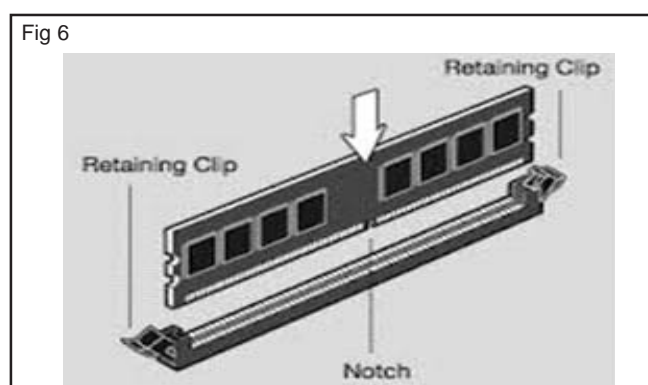
Test and replace the SMPS

Objectives : At the end of this exercise you shall be able to
• **test and replace the SMPS from computer.**

Requirements			
Tools/Equipments/Instruments		**Materials**	
• Trainees tool kit	- 1 Set	• Complete assembly of Computer	- 1 No
• Digital multimeter with probes	- 1 No	• RC Solder	- 10 gm
• Adjustable type Table Lamp	- 1 No	• Paper clip	- 1 No
• Magnifying Lens	- 1 No	• A computer SMPS	- 1 No
• Oscilloscope 0-20MHz Dual manual with probe kit and operation manual	- 1 No		

PROCEDURE

> **Switch Mode Power Supply (SMPS) alternating current (AC) convert into DC current into different output power supply. SMPS power supply to motherboard, Hard disk drive, DVD drive.**

1 Open the computer's casing. Be sure that the computer is completely turned off prior to starting.

2 Remove the screws that are present in the side panel of the computer and need to remove only one side of the panel.

3 Remove the connections from the SMPS to all the peripherals of the computer.

4 Take a paper clip and bent it in a shape of 'U' shape.

5 Find the 24 pin connector from your SMPS (obviously it is the bigger connector from SMPS). Try to locate green and black wire.
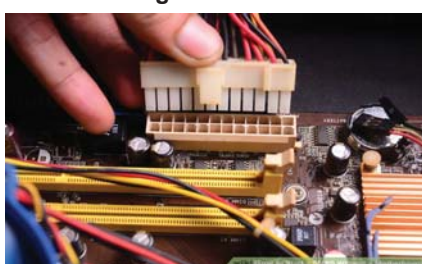
> **Please note, that there will be one green wire and many black wires. You can select any black wire you want.**

6 Insert one end of the bent paper clip into the green terminal and the other end to the black terminal.

7 Turn ON the SMPS with the wire inserted. The SMPS should be running now. If it does not turn ON, insert the paper clip firmly and try once more. If still the SMPS is turn ON, the SMPS might be faulty.

8 If the PSU fan rotates you can 80 % confirm that the unit is functioning well.

9 There are still chances that the PSU can be faulty which can be tested by checking the output volts at the pins.

10 Reconnect the removed connecters and get the work checked by the Instructor.

11 Get the work checked by the Instructor.

Opening Computer Case	Removing SMPS Connectors	"U" Shaped Paper Clip

Selecting Green Wire	Inserting Clip in the Connector	Turning on the SMPS

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Replace the given DVD and HDD on the system

Objectives : At the end of this exercise you shall be able to
• **disassemble the drive cage**
• **disassemble and assemble HDD**
• **reassemble the drive cage inside the cabinet.**

Requirements

Hardware

		• Screwdriver set and anti-static	
• PC with standard configuration	- 3 Nos	wrist strap	- as reqd
• CD/DVD drives	- 2 Nos	• Sticking labels (reusable)	- as reqd
• HDD drives	- 2 Nos	• Anti static covers	- as reqd

PROCEDURE

TASK 1 : **Removing the CD/DVD and HDD from the computer system**

At the time of preparation of this exercise practice sheets, majority of the PC's have a single drive cage which hosts all drives. At the time of using this exercise, if situation is found to be different, the instructor in charge should suitably modify the procedure given below.

A Demonstrate the procedure for removing the drive cage consisting of at-least one HDD from the computer cabinet.

   While demonstrating the following points should be considered;

   • Identifying the mounting type and fixtures used.

   • Use of correct tools and danger in case of using wrong tools.

   • Technique involved in removing the front cover of the processing unit if found necessary.

• Identifying the snap on springs of drive cage

• Identify the drive cage guide in the cabinet

• Technique involved in pressing the snap on springs and taking out the drive cage.

• Precautions to be taken while handling the drive cage such that other components mounted inside the processing unit does not get damaged.

1 As demonstrated by the instructor, unscrew the fixing screws and remove the drive cage slowly& gently without causing damage both to the drives inside the drive cage and to other components/boards mounted inside the processing unit.

2 Get the removed drive cage checked by the instructor.

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TASK 2 : **Removal of the drives from the drive cage**

The instructor has to demonstrate the technique, tips and precautions to be taken while removing the drives from the drive cage. While demonstrating, make the trainees understand why a drive is positioned in that place and why not at a different place in the drive cage.

1 As demonstrated by the instructor, remove all the drives taking sufficient care that the drives are not handled roughly, not dropped or damaged while removing.

2 In each of the drives removed from the drive cage, identify the connectors/ sockets/ jumpers/ switches found at its back/ rear side. Make a rough sketch the connectors / sockets/ jumpers/ switches and record the number of pins and jumpers/ switch settings.

3 Identify and record the specifications of the drives given on the drives.

4 Get the removed drives, identified connectors/ sockets/ jumpers/ switches and recorded specifications of the drives checked by the instructor.

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TASK 3 : **Assembling of HDD into the computer**

A Demonstrate the procedure and technique of assembling:

- HDD into the drive cage.

- Drive cage into the computer cabinet\chassis While demonstrating the following points should be highlighted:

- Handling the drive cage while fitting the drives

- Technique in fitting the drives for correct alignment with respect to front panel.

- Checking the stability and firmness of the assembly

1 As demonstrated by the instructor, reassemble the drives in the order instructed in the drive cage. During assembling do not forget to follow the precautions given by the instructor. Take the advice of the instructor.

2 Get the reassembled drives on the drive cage checked by instructor for its correctness and stability.

B Issue one additional Hard Disk Drive of such a physical size that it can be fitted in the drive cage along with the existing drives.

> **Since the intention of asking the trainees to fix the second HDD is only to make them practice the skill of mounting the device in the drive cage, and practice connecting the cable, the issued HDD's may even be a defective drive. However if the added HDD is a working one, then the trainees can be made to learn the skill of formatting the second drive, taking image of the other hard disk and such other very relevant tasks.**

3 Record the specifications of the second drive to be fixed on the drive cage. As demonstrated by the instructor, fix the given second HDD with great care and patience in the drive cage. Make sure that sufficient space exist between the drives mounted on the drive cage.

4 Get the work checked by the Instructor.

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TASK 4: **Reassembling of drive cage into the computer**

A Demonstrate the procedure for reassembling the drive cage back inside the cabinet.

While demonstrating ensure that stress is made on the following:

- Positioning of the cabinet while reassembling the drive cage.

- Sliding in the drive cage into the cabinet and locking it in position.

- Checking the alignment of the CD/DVD drive with the front panel of the cabinet.

- Snap on springs of drive cage .

- Proper fit of the drive cage guide inside the cabinet.

- Any other points specific depending upon the type of cabinet and drive cage.

1 Slide in the drive cage inside the cabinet as demonstrated by the instructor.

2 Check if the doors of the CD/DVD drive is in place with the front panel.

> **Reposition the drive cage if necessary and fix the screw using the correct type of tool.**

3 Get the reassembled drive cage checked by the instructor.

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Dismantle and assemble the desktop computer system

Objectives : At the end of this exercise you shall be able to
• **dismantle and assemble desktop computer system.**

Requirements

Hardware and software

• Identical PCs with labeled ports,
  connection cables
  (could even be dummy)   - as reqd

• I/O devices such as Keyboard, Mouse
  Monitor, Printer, Multimedia, Speaker,
  CD Drive, DVD Drive and Microphone   - as reqd

• Screw driver set and Allen key
  (depending upon the type of

  fixing used with connectors)   - as reqd
• Sticking labels   - as reqd

PROCEDURE

TASK 1 : **Dismantling and assembling the computer system**

1 Switch off and unplug the power cord from the PC.

2 Remove the component connections from the Cabinet i.e. USB connections, Keyboard/Mouse Connections, LAN Connection, Parallel and Serial Port Connections

3 Ensure no power related connection is there with Cabinet

4 Unscrew the cover that is opposite to the Mother board section, as the motherboard section closure is fully closed by motherboard base, and remove the cover.

5 Remove the SMPS connections to Hard Disk drive, DVD Drive, Motherboard Main Power, CPU Power, Fan Power Connector, PSU Connections, inside the Cabinet.

6 Remove the connectors from devices like SATA/IDE Cables to HDD and DVD, Audio Connectors, Cabinet Front USB/Audio Connectors.

7 Unscrew the motherboard screws, HDD-DVD screws and other removable items and dismantle.

> **Warning: Do not remove or misplace any jumpers placed across the motherboard, as it will result malfunctioning or dead - error motherboard operation.**

> **Note : Now the pc totally dismantled.keep a note of all the parts is being dismantled, which will be easier to re-assemble the system.**

8 Clean the objects with a soft cotton cloth, mild blower etc. to remove dust and patches on them.

> **Note : Don't use any water based cleaner inside the system as it is power conductive and may short-circuit in case of moisture. Keep the parts separated and clean.**

9 Place the SMPS at right position and screw it.

10 Place properly the motherboard on the legs of cabinet. In case any placement problem place the motherboard first and screw it before fixing SMPS.

11 Fix the processor and fan, RAM,PCI Cards which ever removed at proper places.

12 Fix the Harddisk,DVD Drive,Floppy Drive,Other components that to be screwed with the cabinet.

13 Connect the connectors from motherboard to various devices like SATA,IDE,USB Extensions,etc.

14 Plug the SMPS connections to Motherboard,CPU PSU,Devices,which are on power required connections.

15 Screw up the side cover to close the cabinet.

16 Connect the devices and external devices using connectors into motherboard.

17 Connect the power chord finally to the Cabinet.

> **Note: Ensure that all connections are proper Now switch ON the power and switch-ON the system.**

— — — — — — — —

Boot the system from different options

Objectives : At the end of this exercise you shall be able to
• **boot the system using Windows operating system**
• **shut down the computer**
• **change the booting order from HDD to CDROM Drive in BIOS.**

Requirement
Tools/Equipments/Instruments
• Desktop PC   - 1 No

PROCEDURE

TASK 1 : **Booting the system using Windows operating system**

1 Once made all the connection with PC, switch ON the system in the following sequence:

  • AC mains.

  • Stabilizer/CVT/UPS unit (It is recommended to use a stabilizer/CVT/UPS)

  • Power switch of the Distribution box.

  • External peripheral devices such as Printer, Monitor, Speaker, etc.

2 Press the POWER ON switch on the CPU System.

  • Wait and observe the following.

• Beep sound been heard when a computer get started.

• Keyboard lights flashes.

• Mouse light glows.

• Monitor lights glows (turn from yellow to green).

• CD/DVD/Floppy drive lights flashes(turn green).

• Power on LED and Hard disk LED glows on the CPU (turns green).

Printer

• In Dot-matrix / Inkjet (The head moves from right to left and the lights glows).

• In Laser jet (clunking sound and the light glows).

3 Boot process begin and POST operation will Display On the Screen.

> **Usually the computer will beep once or twice on boot up. This is normal, and nothing to worry about. Repeated beeping combined with no display and/or error messages indicate that something might be wrong. Otherwise, your computer will proceed to perform a power-on self test.**

4 Wait a few seconds after that the system will load windows OS and display the screen.

5 Next Windows start up with asking password for enter into Windows.

6 Type the password correctly (ask the password to the instructor) then press 'enter' key for confirmation.

> **Hints: Some computer does not have password. Such case just press ENTER key for Skip Password option.**

7 Next Desktop screen will come.

8 Now the system is ready for use

— — — — — — — —

TASK 2 : **Shutting down the computer**

1 Close all the open programs.

2 Click 'ON' the [ ] button and select [Shut Down] shut down Option.

3 Move the Cursor over option dialog box and select "shut down " option and click "Ok" button.

> **This makes the Windows to close all opened / running applications if any and shuts down all activity on the computer so that the power to computer can be turned off.**

4 Wait till screen goes blank.

> **Although the windows OS closes all running application and then shuts down the PC , it is not recommended to keep any application open at the time of turn off the PC.**

5 Switch 'OFF the supply in the following sequence.

  • External peripheral devices such as printer, Monitor, Speaker, etc.

  • CPU System

- Power 'OFF the Distribution box

- Stabilizer/CVT/UPS unit

- AC mains

6 Get the work checked by the Instructor.

— — — — — — — —

TASK 3 : **Changing of the booting order from HDD to CDROM Drive in BIOS**

1 First start the computer and during the initial booting process display the message.

2 Press Del or 'F2' key on the keyboard to enter into CMOS BIOS setup . The BIOS Setup screen display the startup screen.

> **Entering into CMOS setup by pressing DEL key is not suitable for all PC. The step for Entering into the CMOS setup depends on the motherboard. Press the correct keyboard command for entering into setup display on your computer.**

3 Select Boot Menu option by moving the arrow keys on the keyboard and press enter key.

- Boot option menu display the options.

4 Select removable device option from boot order.

> **BIOS will first try to boot from any removable devices - like floppy drives or flash drives. If no removable devices are bootable, BIOS will next try the hard drive, followed by the CD-ROM drive, and finally the network.**

- Boot order can be changed by pressing the '+'and '-' keys.

5 Set CD ROM drive as a first Boot device and Removable device as a second boot device and hard drive as a third boot devices.

6 Move the arrow key to "Exit" menu and select Exit saving changes option (or Press F10 key on the keyboard) will display on the screen.

- Setup will display the confirmation message on the screen.

7 Select "Yes" by moving arrow key and press ENTER key on the keyboard for save your CMOS.

Configuration changes and exit form setup.

- Now the computer will restart automatically and ready to boot from CD ROM drive by display a message for your confirmation.

8 Press any key to accept boot from CD ROM drive..

- System loads OS from CD ROM drive and starts working.

9 Get the work checked by the instructor.

— — — — — — — —

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Install OS in a desktop computer

Objectives : At the end of this exercise you shall be able to
• **install windows OS on the PC**
• **format a secondary hard drive**
• **install driver software from motherboard CD.**

Requirements	
Tools/Equipments/Instruments	• Operating system CD - 1 No
• A working PC - 1 No	

PROCEDURE

TASK 1 : **Installation of windows OS on the PC**

Enter into CMOS setup

1   Power on PC.

> **Prompt message is displayed as follows**
>
> **Press <DEL> to enter setup**

2   Press <DEL> key

> **Immediately enter into CMOS setup utility menu.**

3   Change the boot sequence by following the steps from 1 to 8 explained in Task 1 of exercise 1.7.82

4   Insert the windows XP installation disk into CD Rom drive.

> **The PC will now restart and see a message at the top of the screen telling to "Press any key to boot from CD " as shown in Fig 1**

5   Go ahead and Press any key for setup to begin

Fig 1
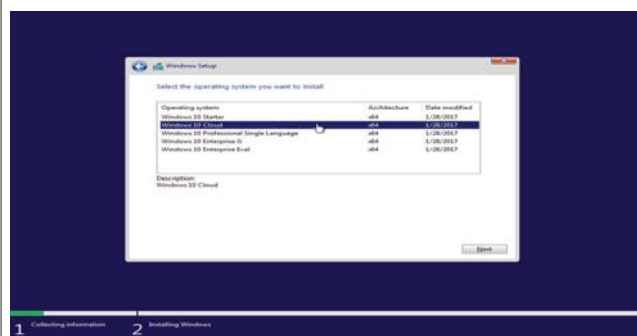
> **Installation of OS will format hard disk. Format will delete all the information stored in the hard disk. Copy all the important documents before start setup.**

• Once setup begins a message stating that setup is inspecting computer's hardware Configuration.

• Then windows will copy files and continue to start setup.

> **Next the setup welcome screen appear.**
>
> **Press Key "R" for repair the existing corrupted Windows OS. If you to stop installation press F3 key.**

6   Press "ENTER" Key to continue windows setup process.

> **Next EULA screen appear on the screen**

7   Press F8 to accept the Windows XP Licensing Agreement.

> **If an existing Windows XP installation is detected, are prompted to repair it. To bypass the repair, press "ENTER" Key**.

Partition the disk

> **All existing partitions and non-partitioned spaces are listed for each physical hard disk.**

> **If you want to create a partition where one or more partitions already exist, first delete the existing partition or partitions, and then create the new partition. You can move the arrow keys to select an existing partition   press D to delete , and then press L (or press ENTER, and then press L if it is the System partition) to confirm that you want to delete the partition. Repeat this step for each existing partition that want to include in the new partition. When all the partitions are deleted, select the remaining non-partitioned space, and then press C to create the new partition.**

8   Use the ARROW keys to select an existing partition, or create a new partition by selecting the non-partitioned space

> **When want to create a new partition can also press C to create a new partition using non-partitioned space.**
>
> **If your hard disk is new one then need to do a partition and format your hard disk.**

9 Press "Enter" key to create the partition.

> **To specify the partition size, type the size in megabytes (MB) for the new partition.**

10 Repeat steps 8 to 9 to create additional partition.

> **OS starts partitioning the total hard disk memory space into 2 or 3 partition as allotted.**

11 Press the Arrow keys to select the partition where you want to install Windows XP, and then press ENTER.

> **The next screen to choose the file system to reformat hard drive.**

12 Select the format option by moving the arrow keys and press "ENTER":

> **Format process will come on the screen.**
>
> **Setup program will now format the partition drive and copy the files followed by a restart.**
>
> **Do not press any key to boot at this point**
>
> **Next screen showing that your computer will restart in 1 minutes.**
>
> **Computer restart with windows XP screen.**

— — — — — — — —

TASK 2 : **Formatting of the secondary Hard drive**

1 Click on icon and click mouse right button it will display a popup menu.

2 Click "Open" option.

> **A screen will display.**

3 Select the "D" drive and right click the mouse will display a popup menu.

13 Setup will now ask to select language

14 Move the cursor to US and English click "Next " Tab Enter your name and organization appear on the screen.

15 Select "Next" tab to continue installation.

16 Type product ID code on the next screen.

> **Product ID code is available on the side of the computer Tower or CD cover.**

17 Enter Name of the computer , Administrator password and confirm the password by retyping the password again asked in the next screen.

> **If not interested to give password then just press "Enter" key to skip the Step.**

18 Click "Next " Tab to go to Time zone screen.

19 Set month, date, time and Click "Next" tab.

> **Wait for the Next Network settings screen appear on the screen.**

20 Click "Next" tab to finish installation.

> **Computer restart with Windows XP OS followed by Desktop screen.**

4 Select "Format" option.

> **A screen will display on the screen.**

5 Select "NTFS" and Click "Ok" button.

— — — — — — — —

TASK 3 : **Installation of the Driver software from motherboard CD**

1 Insert Motherboard CD into CDROM Drive.

2 Follow the instructions shown on the screen to install sound driver, Network driver etc.,

3 System will restart after every driver files are copied to the system to activate the hardware.

> **Motherboard CD contains all the driver software to activate all Hardware components assembled in motherboard.**

4 Get the work checked by the Instructor.

— — — — — — — —

Install a printer driver software and test for print outs

Objectives : At the end of this exercise you shall be able to
• **install a printer on Windows**
• **perform self test on printer**
• **manage print queue.**

Requirements
Tools/Equipments/Instruments

•	A working PC	- 1 No
•	Printer with driver CD	- 1 No

If have a laser printer, allow a few inches of space on all sides for ventilation	**Install printer driver software according to the manufacturer's instructions given in the CD.**

PROCEDURE

TASK 1 : **Installation of a Deskjet 6500 series Printer on Windows.**

1 Connect the power cable to the AC mains.

2 Connect the data cable to the suitable port.

3 Switch on the printer and system.

4 Click on the **start** button found at the left corner of the taskbar.

On clicking the start button, a menu list pops ups as shown in Fig 1.

Fig 1
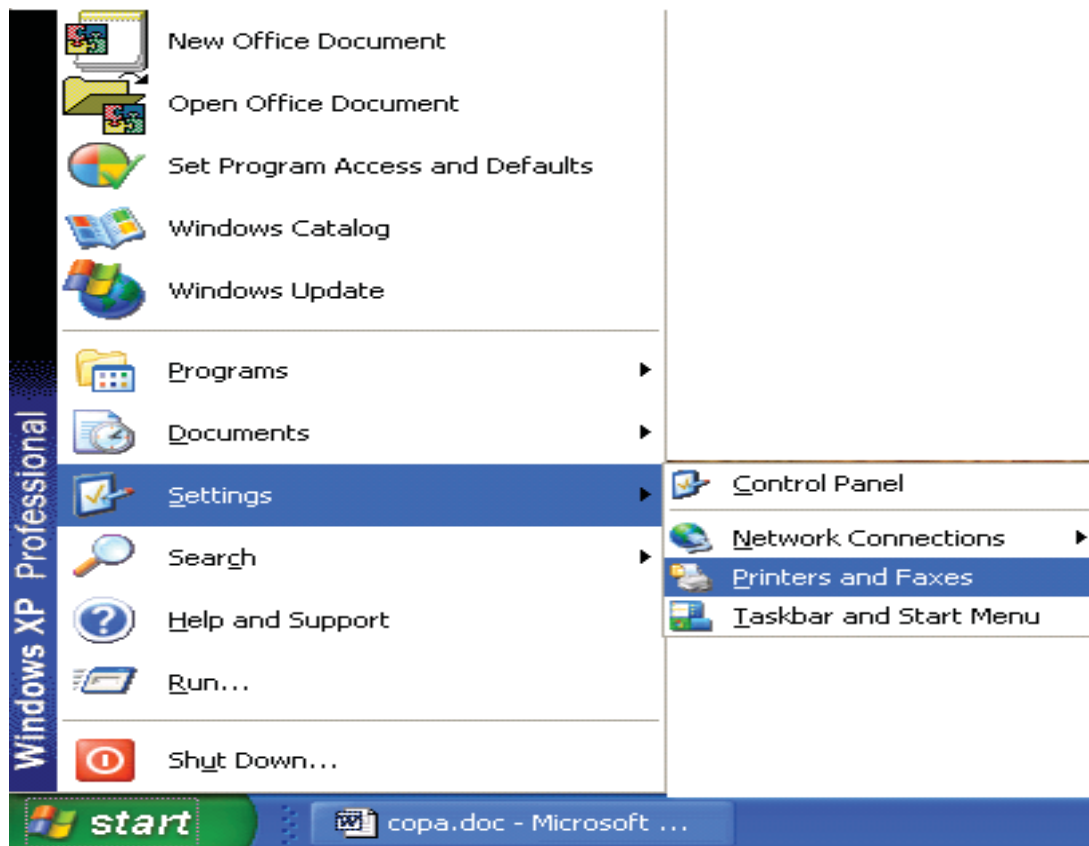
6 Take the cursor over 🖨 Printers and Faxes and double click a screen will appear as shown in Fig 2

Fig 2
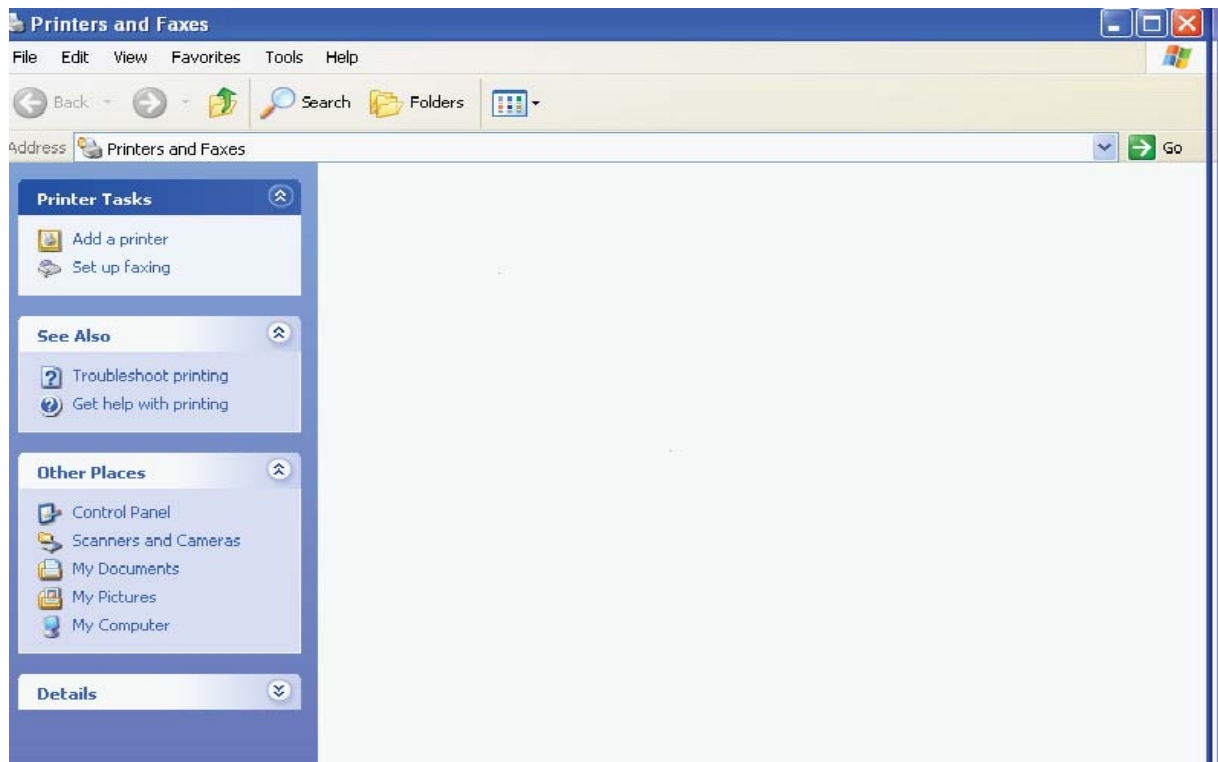
7 Click the right mouse button. The following popup menu will appear as shown in Fig 3.

Fig 3

8 Move the cursor over "Add printer" and double click the mouse.

9 Click "Next " tab in the Add Printer wizard .

10 Local or Network printer wizard will appear on the screen.

11 Select "Automatically Detect and Install My Plug and Play Printer option and then click "Next" tab

12 Now the computer will try to automatically detect and install printer driver software . The computer not able to detect the software then it will display the Next wizard.

13 Click "Next" Tab .

14 Select printer port wizard which appears on the screen.

15 Create a new port for the printer or select the default printer port given in the Wizard.

16 Next Install printer software wizards appeared on the screen with printer Manufacture's name and model of the printer.

17 Look for your printer in the list.

18 From the list if find the printer then click "Next" and proceed to the "Install the Printer Driver" wizard.

19 Give name of the printer asked in the name printer wizard.

20 Select "Yes" to set install printer as a default printer to the computer.

21 Click "Next" tab.

Print test page wizard will appear.

22 Select " Yes" to print a test page.(if don't want to print then select "No")

23 Click "Next" tab.

24 Installation process will complete and a Wizard will appear on the Screen.

25 Click " Finish" tab

Printer will print the test page .

26 Get the work checked by the instructor.

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If Printer Driver Not Listed?

1 Click "Have disk" tab on Install printer software wizard.

Fig 4

2 Insert the printer driver CD into CDROM drive given by the manufacturer.

3 Click and select CDROM drive

4 Locate the setup file from CDROM drive

5 Click "OK "tab.

6 Move the mouse to the printer name and Click .

7 Click "Next" tab.

8 Select the type of connection and click "Next" tab.

Fig 5

Fig 6

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.84
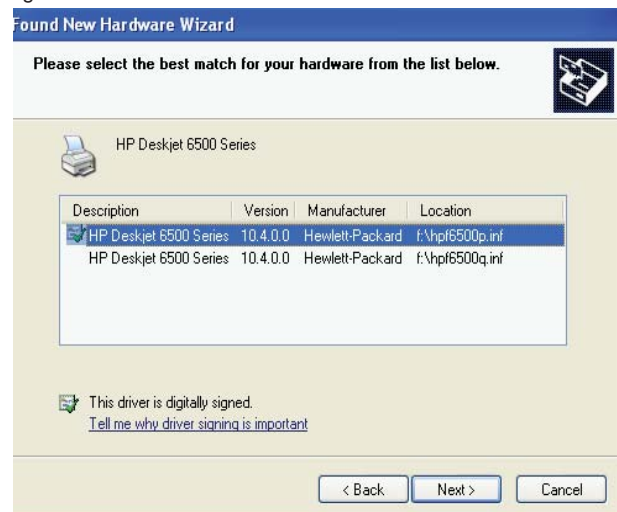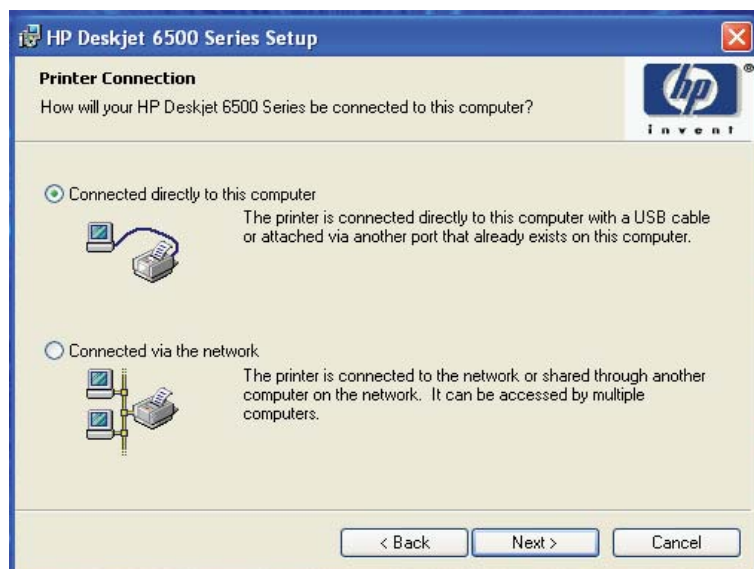
9 Accept the license by click the option .

10 Click "Next" tab.

11 Select the Printer connector type from the Connector Type Wizard .

12 Click " Next" tab

13 Click "Install " tab from the wizard.

> **Now the Computer will start copy driver software from CD.**
>
> **Next wizard shown in Fig 7 will display on the screen.**

14 Select Print a test page option and click "Finish" tab.

> **Completing the Add printer Wizard will display on the screen.**

15 Click " Finish " Tab.

16 Test Print page will print on the paper.

Fig 7
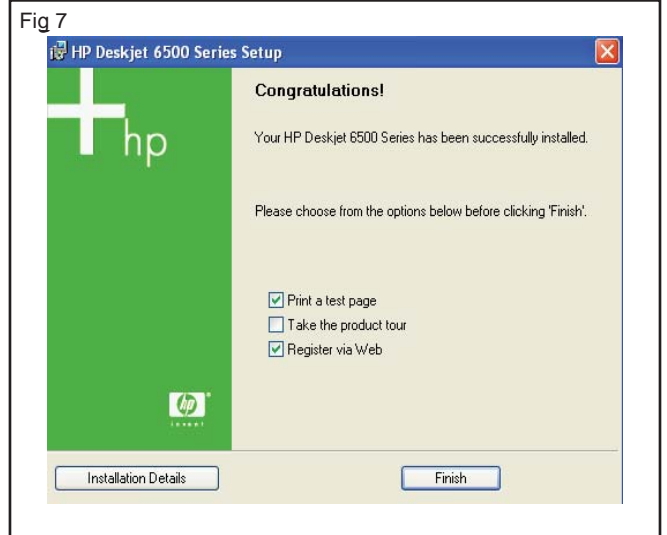
17 Show the test page to the instructor.

— — — — — — — —

TASK 2 : **Performing a Self - Test on Printer**

1 Turn on your computer and printer.

2 Click" start" on your Windows taskbar.

3 Choose "Control Panel" then

4 Click" View Installed Printers".

5 Right click on the installed printer icon.

6 Click "Print Test Page" to start the self-test.

> **Perform a self-test each time you install a new ink cartridge, or when your print quality is low.**
>
> **The self-test will not work well if the printer ink levels are low.**

TASK 3 : **Managing the Print Queue**

1 Open Microsoft Word and Open an existing document.

2   Print the document using print command.

> **After issuing Print command a printer icon will be displayed in the system tray.**

3 Move the mouse cursor over the printer icon displayed in the system tray and Double click on it.

> **A Printer dialogue box will be displayed. In that dialogue box the list of print job(s) and its software and status , owner and number of pages, port time and date (when it was started) and its size will be displayed. Also the name of port in which the job is being printed.**

To Pause printing

4 Select the print job in the list which you want to pause,

5 Click Document menu in the dialogue box (a pull-down menu will be displayed) and click on Pause command.

The printing process will be paused.

6 Repeat the previous step and select Restart to restart the printing process.

To Cancel printing process

7 Select the print job in the list which you want to cancel printing,

8 Click Document menu in the dialogue box (a pull-down menu will be displayed) and click on Cancel command.

The printing process will be cancelled

— — — — — — — —

Install antivirus software, scan the system and explore the options in the antivirus software

Objectives : At the end of this exercise you shall be able to
• **install antivirus software from a disc**
• **install antivirus software from internet**
• **scan the system for virus.**

Requirement
Tools/Equipments/Instruments
• Computer or Laptop with Windows operating system - 1 No
• CD of antivirus software - 1 No

PROCEDURE

TASK 1 : **Installation of antivirus software from a Disc**

1   Load the anti-virus CD-ROM into the disc tray and close, then wait for the CD menu to appear on screen.

Step 1: Click the "Install Now" button

This should be located in the lower left hand corner of the web site. Clicking this button begins the process.

Step 2: Download the required files

After you click the "Install Now" button, the required files will automatically download to the computer.

Fig 1
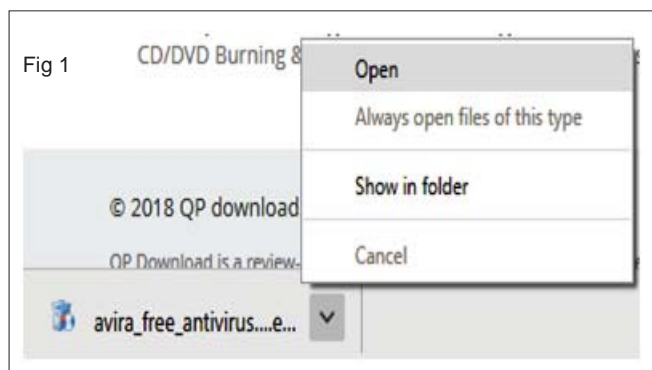
2   Type in the product security code in the boxes on the screen.

> **The security code is printed on the back of the plastic case for the CD-ROM containing the anti-virus software.**

3   Follow the on-screen prompts, clicking "Yes" when asked, "Do you wish to install this software?"

4   Reboot the computer when the installation is complete.

This involves shutting down and restarting the computer so the anti-virus settings can take effect.

5   Get the work checked by the Instructor.

— — — — — — — —

TASK 2 : **Installation of Antivirus Software From the Internet**

1   Go to an anti-virus software company site on the Internet to purchase an anti - virus program.

Fig 2

Some offer trial versions of anti-virus programs for free.
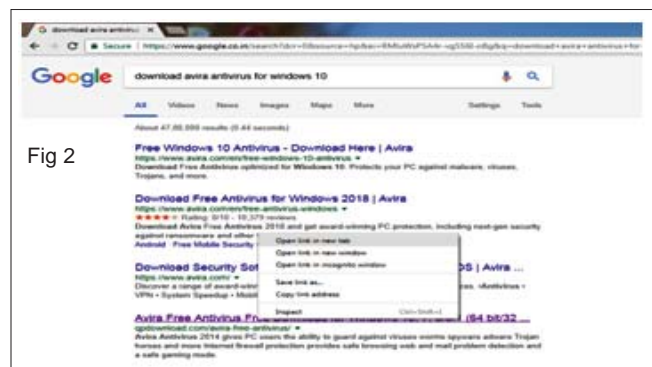
2   Choose the software product, wish to purchase from the company's menu of offerings and click "Buy Now" or Download Now".

3   Enter the credit and other personal information in the required fields to purchase the software, then press "Enter".

4   Follow the on-screen prompts, clicking "Yes" when asked if wish to download the software to the computer.

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5 Wait for the download to complete.

> **This could take several minutes, depending on the speed of the Internet connection. Do not log off the computer or change any setting until the software has finished downloading to the system.**

6 Reboot the computer if prompted at the end of the download.
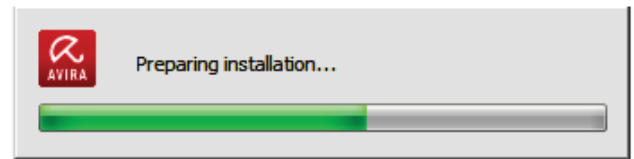
7 Get the work checked by the Instructor.

Fig 3

Fig 4

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TASK 3: **Scanning the system for virus**

1 Go and select the anti-virus software from the start menu.

2 Find the system SCAN button on software screen

3 Click the button for scan

4 Observe and study the status report of software

5 Observe the virus and warning shown by the software.

6 Get the work checked by the Instructor.

— — — — — — — —

Install MS Office software

Objectives : At the end of this exercise you shall be able to
• **install the MS Office software in the Personal Computer.**

Requirement	
Tools/Equipments/Instruments	**Materials/Components**
• Trainees tool kit - 1 Set • Personal Computer - 1 No	• Microsoft Office-2007 Enterprises CD - 1 No

PROCEDURE

1 Insert the Microsoft Office-2007 Enterprises CD in the DVD drive. If the setup wizard does not automatically begin, Click Start> Run > D:\ setup.exe.

2 Enter the product key from the back of the EC jacket and click "Continue".

3 Next Microsoft License terms will display on the screen. Read the terms and accept the License Terms and click the "Continue" button.

4 Choose an installation option.

a Upgrade (Remove Office 2003 or old version)

b Customize (Keep office 2003 installed and adds office 2007 allowing you to use them both)

• If you click "Upgrade", go on to Step-7.

• If you click "Customize", go on to Step-5.

5 Click the Radio button for "Keep all previous version".

6 Click the installation option tab, left-click the first drop down box and click "Run all from My Computer". Then click "Install Now".

7 Installation will begin. It may take 15 to 30 minutes to finish.

8 Click Close to complete the installation.

9 First time launch any Office Program, will be prompted to activate the software. As long as have an active Internet connections choose the default option and click "Next".

10 When the activation finishes, click "Close".

11 Click "Ok" to finish.

12 Get the work checked by the Instructor.

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Create folder and files, draw pictures using paint

Objectives : At the end of this exercise you shall be able to
• **create document file in windows explorer**
• **create folder in windows explorer**
• **open paint brush and new drawing**
• **draw different types of lines**
• **identify and work with paint brush tools**
• **save clippings to disk.**

Requirement

Tools/Equipments/Instruments

• Desktop Computer or Laptop
  with windows OS, MS-Office   - 1 No

PROCEDURE

TASK 1 : **Creating Document file in windows Explorer**

1 Click start button in task bar and click "Computer" program list or press

windows key [image] + E in the key board

The windows explorer window will appear.

2 Select and double click the LocalDisk (D:), already created files and folders are displayed.

3 Right click on "D:" drive.

4 Select "New" Option and click Microsoft Word Document".

5 Delete the "New Microsoft Document"

6 Type any file name as you like for eg: Sample and press Enter key.

7 Double click the "Sample" file , type any text and save the file.

8 Get the work checked by the Instructor.

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TASK 2 : **Creating folder in Windows Explorer**

1 Follow the steps 1 and 2 in Task 1.

2 Right click and select New option and click "Folder".

3 Type any "Folder Name" as you like for Eg: Electronic Mechanic.

4 Press Enter Key.

5 Get the work checked by the Instructor.

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TASK 3 : **Starting a Paintbrush and new drawing**

Start a Paintbrush:

1 Open **Accessories** in Windows

2 Choose **Paintbrush**

Begin New Drawing:

1 Choose **File**

2 Choose **New**

Loading a Drawing:

1 Choose **File**

2 Choose **Open**

Color or Black & White

1 Choose **Options**.

2 Choose **Image Attributes.**

3 Choosing Black and White will give pattern fill options. Choosing Color will give color fill options.

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TASK 4 : **Drawing a line**

Draw a Straight Line:

1   Choose

2   Drag and release to complete.

Line Color:

1   Line tools will use the foreground color (or pattern if in black and white) as selected from the Palette with the **left** mouse button.

2   Lines around circles, rectangles, polygons, etc. will use the background color as selected from the Palette with the **right** mouse button.

TASK 5: Working with Paintbrush tools

Circle/Ellipse Tool:

1   Choose with the left mouse button. (Holding down shift while placing points forces a circle)

2   Place corner point (of an imaginary box around the circle) and press the left button.

3   Drag to opposite corner point and release.

Box Tool:

1   Choose with the left mouse button.(Holding down shift while placing points forces a square)

2   Use left mouse button for one corner. Drag to opposite corner point and release.

Draw a Splined Line:

1   Choose

2   Click on line start. Drag to end.

3   Click to one side of the line and drag to stretch line into a spline.

4   Repeat (3) for second stretch.

Zooming In:

It is possible to modify a painting pixel by pixel.

1   Choose **View**.

2   Choose **Zoom In**.

3   Select the zoom area.

4. Click on pixels to change them to the foreground color.

Zooming Out:

1   Choose **View** menu.

2   Choose **Zoom Out.**

3. Fill color is the same as foreground color.

Draw a Freehand Line:

1   Choose the paintbrush icon.

2   The brush shape can be that of a dot, a rectangle or a line.

3   Change the shape of the brush with the **Brush Shapes** option under **Options**.

— — — — — — — —

Line thickness:

Point and Click on icon with the left mouse button.

Erasing:

Choose 1) or 2) icon with the left button.

1   Erases the foreground color only and replaces it with background.

2   Erases both foreground and background to white.

Spray Paint (Air Brush):

1   Choose the icon. Hold down the left mouse button to spray.

2   Note the paint used by the sprayer is set by the color below.

3   The width of the spray pattern is set by the line thickness below.

Move Objects or Areas:

1   Outline the area with irregular or rectangular scissors icon. Use the left mouse button and drag.

2   To move, point to the center of the outlined area and drag.

> **If you use the left mouse button to move the area, the background colors or patterns will become transparent. If you drag with the right mouse button, both the foreground and background colors are retained and moved together**

Fill an Area:

1 Choose the paint roller Set the fill type by clicking on the color or pattern along the bottom of the screen.

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TASK 6: **Saving the Clippings to Disk**

1 Outline the area with irregular or rectangular scissors .

2 Choose **Edit** and **Copy** to put it on the clipboard (or) choose **Edit** and **Copy** to save the clipping under several different bitmap options. This is useful for preparing graphics for other programs because only the selected area is saved, minimizing the file size.

Text:

1 Choose

2 Point to start location with left button.

3 Type, Return key is carriage return.

Change font **Style** and **Size** before choosing another tool.

2 Move icon until the **point** of the paint roller shadow is in the area to fill, and click. (If too much area is filled, use the **Undo** under the **Edit** menu).

Other Modifications:

Once a cutout has been defined, it may be modified with **Pick** options: rescaled with **Shrink and Grow**,

skewed with **Tilt**, flipped with **Flip Vertical** and **Flip**

Horizontal or changed dark to light with **Inverse**, and made inverse (negative image) by using the options in the **Pick** menu.

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> **Mistakes:**
> **Before doing anything else, choose Edit and Undo, as this undoes only the last process. You can also Press Esc to stop most processes.**

Calligraphy:

Choose the icon. Change the shape of the brush with the **Brush Shapes** option under **Options**. Also, the line thickness must be set greater than minimum. Note that the paint used by the brush is set by the foreground color or fill pattern below.

Use the Full Screen:

Choose **View**. Choose **View Picture**. <**Esc**> to get back.

Saving:

1 Open **File** menu with left mouse button.

2 Select **Save as ...**

Quitting:

1 Choose **File**

2 Choose **Exit**

— — — — — — — —

Explore different menu/tool/format/status bars of MS word and practice the options

**Objectives :** At the end of this exercise you shall be able to
• **create a word document and identify its components**
• **create resume**
• **format the document using tools**
• **insert picture and clip art, word art.**

Requirement
Tools/Equipments/Instruments
• Desktop Computer or Laptop with windows OS and MS office   - as reqd **Software** • Installation MS office Software   - as reqd

PROCEDURE

TASK 1 : **Creating a word document and identifying its components**

1 Open a new word document.

2 Identify the various screen components as in below Fig.

— — — — — — — —
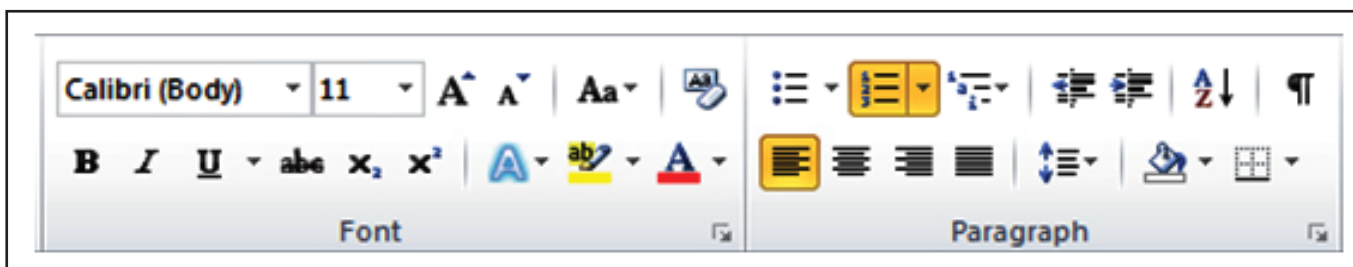
TASK 2 : **Creating a Resume of a Candidate**

1   Type the following in the document.

RESUME

Name : G.Raghavan

Date of Birth : 17.08.1994

Gender : Male

Father Name :R.Gnaneshwar

Religion : Hindu

Nationality : Indian

Category : General

Address : No.12/38, Nageswar II Cross, III Phase, Harikrishna Apts., Chandan Circle, Malleswaram, Bangalore.

Mobile : 09833156987

Email :raghavan_009@gmail.com

Qualification :
Degree : B.Com, Completed in National College, KCR, Karnataka, 2014 PGDiploma : PGDCA, Completed in Manipal Institute, Sadasiva Nagar, Bangalore. PGDPMIR , Completed in Manipal Institute, Sadasiva Nagar, Bangalore.
Experience : 2 Years as Assistant Manager @ Shiv Hundai, JT Nagar, Bangalore.
Languages Known : Kannada, English, Hindi,

Telugu

Hobbies : Social Networking, Marketing studies

Declaration :

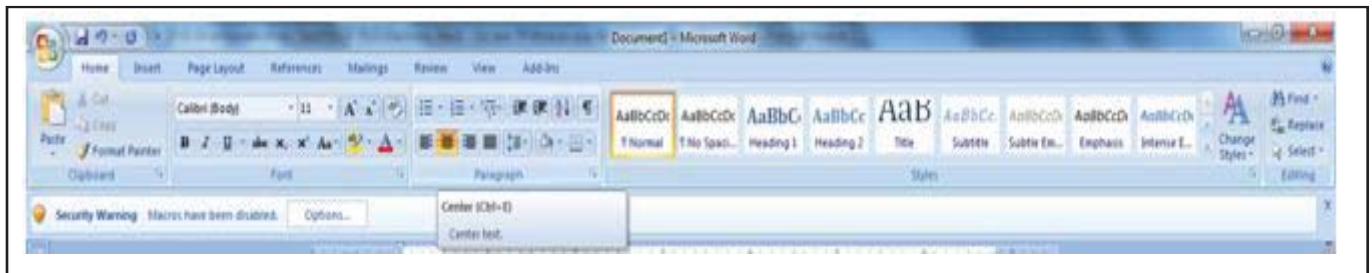All the above said information are true and fair to the best of my knowledge

Station : Bangalore

Sincerely yours,

Date :

— — — — — — — —

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TASK 3 : **Formatting the document using tools**

1   Select the title 'Resume' and center it using Center Align Tool in the Paragraph block

Note : Font and formatting options are available in the main ribbon as in fig shown.

2   Make it Bold using Bold option below the Font tab.

3   Align the name, ':' and name of the candidate with TAB as like below

     Name : G.Raghavan

4   Align other lines with ':' according the above line to make it uniform aligned upto email.

5   Make it Bold and underlined the Qualification and Experience titles.

6   Set the alignment for Degree and others with proper TAB values.

7   Make uniform for experience, Languages and Hobbies also.

8   Make the Declaration into the center alignment and bold.

9   Make the declaration text center aligned.

Note : The document view will be as below after alignment is over.

RESUME

Name	:	G.Raghavan
Date of Birth	:	17.08.1994
Gender	:	Male
Father Name	:	R.Gnaneshwar
Religion	:	Hindu
Nationality	:	Indian
Category	:	General
Address	:	No.12/38, Nageswar II Cross, III Phase,
		Harikrishna Apts., Chandan Circle,
		Malleswaram, Bangalore.
Mobile	:	09833156987
Email	:	raghavan_009@gmail.com

Qualification :

Degree   : B.Com, Completed in National College, KCR, Karnataka, 2014
PGDiploma   : PGDCA, Completed in Manipal Institute, Sadasiva Nagar, Bangalore.
                      PGDPMIR , Completed in Manipal Institute, Sadasiva Nagar, Bangalore.

Experience   : 2 Years as Assistant Manager @ Shiv Hundai, JT Nagar, Bangalore.

Languages Known : Kannada, English, Hindi, Telugu

Hobbies   : Social Networking, Marketing studies

Declaration

All the above said information are true and fair to the best of my knowledge

Station : Bangalore   Sincerely yours,

    Date :

10 Save the document for reference.

11 Get the work checked by the Instructor.

— — — — — — — —

TASK 4 : **Insert picture and clipart, wordart**

1 Create a Text box on the right top corner of the resume using Insert->Textbox as in Fig 1
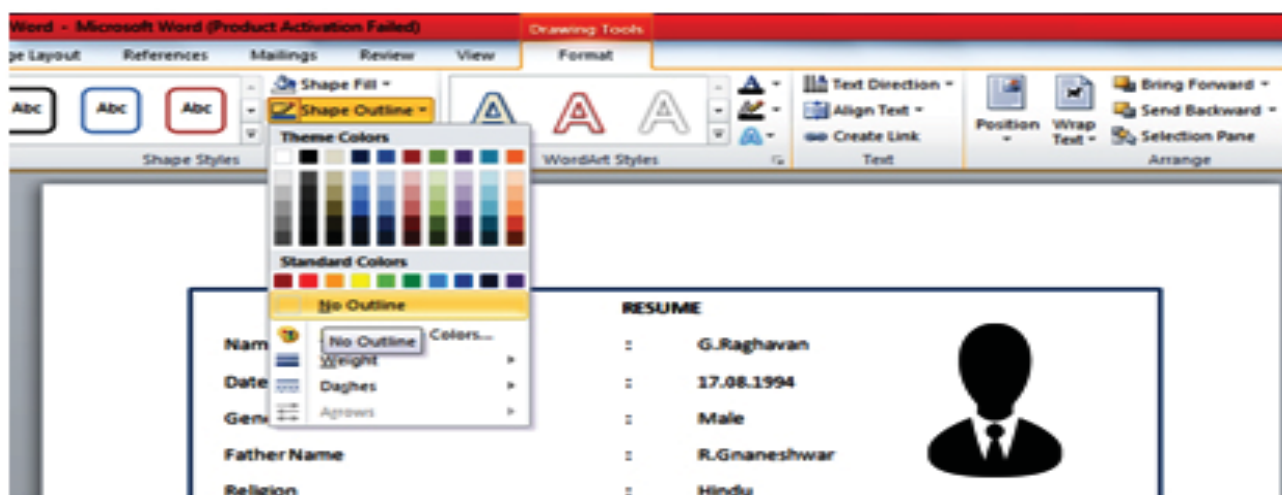

Fig 1

2 Insert picture of the applicant using Insert->Picture option into the text box as in Fig 2.

Fig 2

3 Select the text box and remove its outline by double Click on the text box, Drawing Tool->Shape Outline to NO OUTLINE as in Fig 3.

Fig 3

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.88

4 Select Resume and make it as word art using Insert->Word as in Fig 4 and apply a style to get the word Resume to appear in a stylish appearance.

Fig 4

5 The final appearance of the title may be as in Fig 5

Fig 5

Note : If misalignment occurs while making title design, do delete the title and insert a new word art to make the title as Resume.

— — — — — — — —

Explore different menu/tools/format/status bars of MS Excel and practice the options

Objectives : At the end of this exercise you shall be able to
• **create excel file**
• **create model marksheet**
• **use simple formula for calculations**
• **formatting worksheet.**

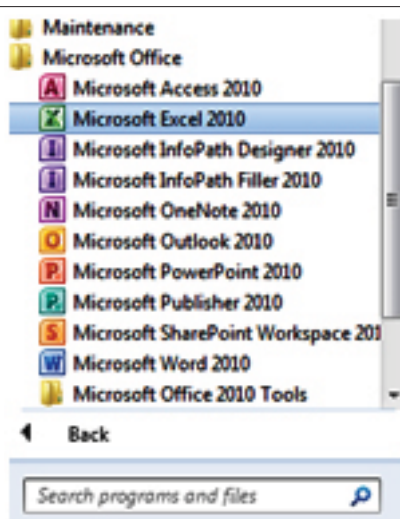| Requirements |
|---|
| **Tools/Equipments/Instruments** |
| • Desktop computer (or) Laptop with MS office   - 1 No |

PROCEDURE

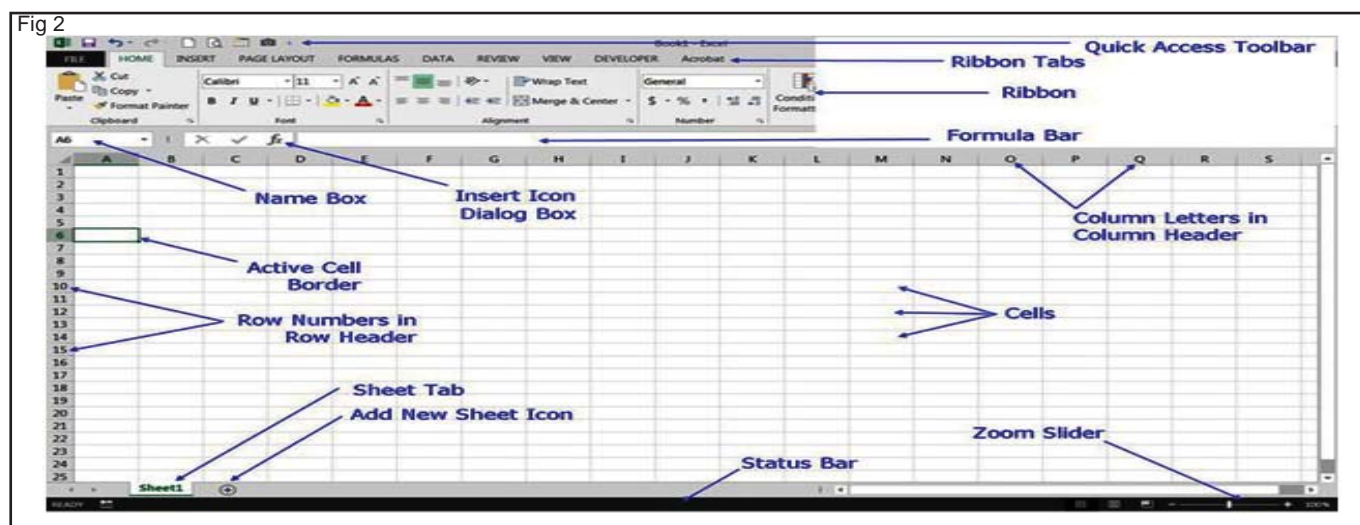TASK 1 : **Creating Excel file and identifying its components**

1   Open Microsoft Excel start menu

Fig 1

2   Find the screen elements and its names

Fig 2

3   Save the file as 'myexcefile.xlsx'

— — — — — — — —

TASK 2 : **Creating a model marksheet of students**

1 Set cursor point to cell A1

2 Type the tiles of the marksheet columns as below:

A1 : Sl. No., B1 : Name of Student, C1 : Class. D1 : Language, E1 : English, F 1 : Maths, G1 : Science, H1 : Social Science, I1 : CCE, J1 : Total, K1 : Average, L1: Status

3 Create Students List as below table :

Sl. No	Name of Student	Class	Lan	Eng	Maths	Science	S Science	CCE	Total	Average	Status
1	Nagaraj	VII	58	70	98	88	67	70	451	75%	
2	Manjunath	VII	70	70	88	76	55	80	439	73%	
3	Sabir Ali	VII	58	85	99	94	73	92	501	84%	
4	Albert	VII	82	85	89	81	84	68	489	82%	
5	Raju	VII	33	42	60	31	55	60	281	47%	

Note : The excel sheet cells are not auto adjusted. Use the Ribbon->Format->Autofit Column Width to make the contents of the columns to fit accordingly as in Fig.

4 Save the file for future use.

— — — — — — — —

TASK 3 : **Using simple formula for calculations**

1 Open the saved Excel file.

2 Select the cell J2, which requires a total of marks.

3 Enter the formula for sum of the mark values as '=SUM(D2:H2)', which calculates the sum for cells from

   D2 to H2, i.e. 381.

4 Select the Formula cell and place the mouse cursor at the right bottom of the cell to drag+copy to other cells.

5 Drag the point up to the cell J6 to copy the formula for the following cells.

6 Calculate average from the total and no. of subjects with the formula '=AVERAGE(D2:H2)'

7. Set round off value for average using formula '=ROUND(AVERAGE(D2:H2),0)'

8 Drag the formula to next following cells.

	A	B	C	D	E	F	G	H	I	J
1	Sl.No	Name of student	Class	Language	English	Maths	Science	S Science	CCE	Total
2	1	Nagaraj	VII	58	70	98	88	67	70	451
3	2	Manjunath	VII	70	70	8	76	55	80	439
4	3	Sabir Ali	VII	58	85	99	94	73	92	501
5	4	Albert	VII	82	85	89	81	84	68	489
6	5	Raju	VII	33	42	60	81	55	60	281
7										

	A	B	C	D	E	F	G	H	I	J	K	L
1	Sl.No	Name of student	Class	Language	English	Maths	Science	S Science	CCE	Total	Average	Status
2	1	Nagaraj	VII	58	70	98	88	67	70	451	75	
3	2	Manjunath	VII	70	70	8	76	55	80	439	73	
4	3	Sabir Ali	VII	58	85	99	94	73	92	501	84	
5	4	Albert	VII	82	85	89	81	84	68	489	82	
6	5	Raju	VII	33	42	60	81	55	60	281	47	
7												

9　Obtain result of the student as mark should be higher than 35 in all subjects using the formula as:

' =IF(AND((D2>34),(E2>34),(F2>34),(G2>34),(H2>34),(I2>34)),"PASS","FAIL") '

Note : IF is a logical condition which could generate result based on condition and pass success or failure value to the cell. AND logic makes the following conditions are true in whole. The results value to be in success it is PASS and in failure its FAIL.

10 Drag the status / result cell to the following cells also.

11 The final sheet will be as in below Table.

12 Save the file for reference and refer instructor for formula related issues.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Sl.No	Name of student	Class	Language	English	Maths	Science	S Science	CCE	Total	Average	Status
2	1	Nagaraj	VII	58	70	98	88	67	70	451	75	PASS
3	2	Manjunath	VII	70	70	8	76	55	80	439	73	PASS
4	3	Sabir Ali	VII	58	85	99	94	73	92	501	84	PASS
5	4	Albert	VII	82	85	89	81	84	68	489	82	PASS
6	5	Raju	VII	33	42	60	81	55	60	281	47	FAIL
7												

Prepare power point presentation on any three known topics with various design, animation and visual effects

Objectives : At the end of this exercise you shall be able to
• **create a new slide, insert bullet and numbering**
• **add animation, transition and sound in a powerpoint presentation.**

Requirements
Tools/Equipments/Instruments
• Trainees tool kit - 1 Set • Personal Computer - 1 Set

PROCEDURE

TASK 1 : **Adding Text Using the Placeholders**

1 Click **Start → All Programs → Microsoft Office → MS Powerpoint** option. A Microsoft Power Point window appears.

2 Click the **Home** tab located on the Ribbon.

3 Click the upper part of the **New Slide** button. The slide with placeholders appears.

4 Click the placeholder and start writing the text.

Adding Text Using a Text Box:

5 Click the **Insert** tab.

6 Click the **Text Box** button, in the **Text** group. A cross hair pointer appears.

7 Drag the cross hair pointer on the slide to create the text box of the desired size and release the mouse-button.

8 Click inside the text box and start typing.

Changing the Text Direction and Aligning the Text:

9 Click the **Home** tab.

10 Click the Text Direction button in the Paragraph group. A drop-down list appears.

11 Select the More Options option of the drop-down list.

12 A Format Text Effects dialog box opens.

13 Modify the settings and click the Close button. The Text changes in the slide according to the settings.

Formatting the Text:

14 Select the text you want to format.

15 Click the Home tab.

16 In the **Font** group, click the Dialog Box Launcher button. A font dialog box appears.

17 Set the following as per the requirements;

 • Font colour

 • Font Style

 • Font type

 • Font size

18 After selecting the desired settings, click the OK button.

Applying the Bulleted List:

19 Select a paragraph to apply the bulleted list in the MS Powerpoint presentation.

20 Click Home tab.

21 In the Paragraph group, click the Bullets combo box. A drop-down list appears.

22 Select the desired bullet list style. The selected bulleted style is applied to the paragraph.

Rearranging and Deleting the slides:

23 Click the desired slide in the Slides tab in the MS powerpoint presentation.

24 Drag the mouse to the location to replace the slide. In the position of the slide has changed as compared to its earlier position.

25 Click the slide to delete.

 Click the Home tab.

26 In the Slide group, click the Delete button.

27 The selected slide gets deleted from the MS Powerpoint presentation.

28 And also select the slide that want to delete and then press the Delete button from the keyboard.

Saving the presentation:

29 Click the Office button. A dropdown list appears.

30 Click the Save option. A Save As dialog box appears.

31 In the Navigation pane, click the folder to save the MS PowerPoint presentation.

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32 Type a name for the presentation besides the File name option.

33 In the Save as Type option, click the down arrow button. A drop-down list appears.

34 Select the desired save as type. (i.e. PowerPoint Presentation).

35 Click the Save button to save the presentation.

36 Get the work checked by the Instructor.

— — — — — — — —

TASK 2: **Adding Animation**

1 In the MS PowerPoint presentation, click the slide where you want to add the animation.

2 Select the Animation tab on the Ribbon.

3 In the Animations group, click the Animate combo box. A drop-down list appears.

4 Select the desired animation option from the drop-down list. The selected animation is applied to the slide. And view the presentation in the Slide Show view and watch the animation effect.

> **Note: When adding animation to an object or text in a slide, a mark in the shape of a star appears in the Slide Show view beside the slide. And select any object or text inside the selected slide. If wants to select multiple object at once, press the Shift key and click the object to select them.**

Applying Custom Animations:

5 In the MS PowerPoint presentation, select the object to which you want to add custom animation. If you want to select multiple objects at once, then press the Shift key and click the object to select them.

6 Select the Animations tab.

7 Click the Custom Animation button in the Animation group. The Custom Animation task pane appears at the right side of the workspace.

8 Select the object or text.

9 Click the Add Effect button. A drop-down list appears.

10 Place the mouse pointer over the desired effect category. A sub-menu appears.

11 Select the desired effect from the sub-menu.

12 Click the Start combo box in the Custom Animation task pane. A drop-down list appears.

13 Select the desired option from the list. The animation is played according to the option selected in the drop-down list of the Start combo box.

14 Next, click the Direction combo box. A drop-down list appears.

15 Select the desired option to specify the direction from where animation will start.

16 Click the Speed combo box. A drop-down list appears.

17 Click the desired option from the drop-down list to specify the speed of the animation.

18 Click the Play button to view animation in the Normal view. Alternatively, you can click the Slide Show button to view the animation in the Slide Show view.

19 Click the Close button to close the Custom Animation Task Pane.

Adding Transition

20 In the MS PowerPoint presentation, select the slide in which you want to add the transition effect.

21 Select the Animations tab.

22 Click the More button in the Transition to this Slide group. A drop-down list appears with various transitions effect options.

23 Select the desired transition effect for your slide. A star mark appears beside the slide in the Slides tab to indicate the transition effect is applied.

24 You can view the presentation in the Slide Show to check the transition effect.

Adding Transition Sound

25 In the MS PowerPoint presentation, select the Slide in the Slides tab, in which you want to add transition sound.

26 Select the Animations tab.

27 Click the Transition Sound combo box in the Transition to this Slide group. A drop-down list appears.

28 Select the desired sound effect for the slide from the drop-down list. After selecting the sound effect, the drop-down list disappears and the selected sound effect is applied to the slide.

29 To remove transition sound, click the No Sound option in the drop-down list.

Adding Transition Speed

30 In the MS PowerPoint presentation, select the Slide in the Slides tab, want to add transition speed.

31 Select the Animations tab.

32 Click the Transition Speed combo box in the Transition to This Slide group. A drop-down list appears.

33 Select the desired speed level for the slide.

34 Click the Preview button. The slide runs in the Preview view to rehearse the animation placed in the presentation.

35 Get the work checked by the Instructor.

— — — — — — — —

Convert the given PDF File into Word File using suitable software

Objectives: At the end of this exercise you shall be able to
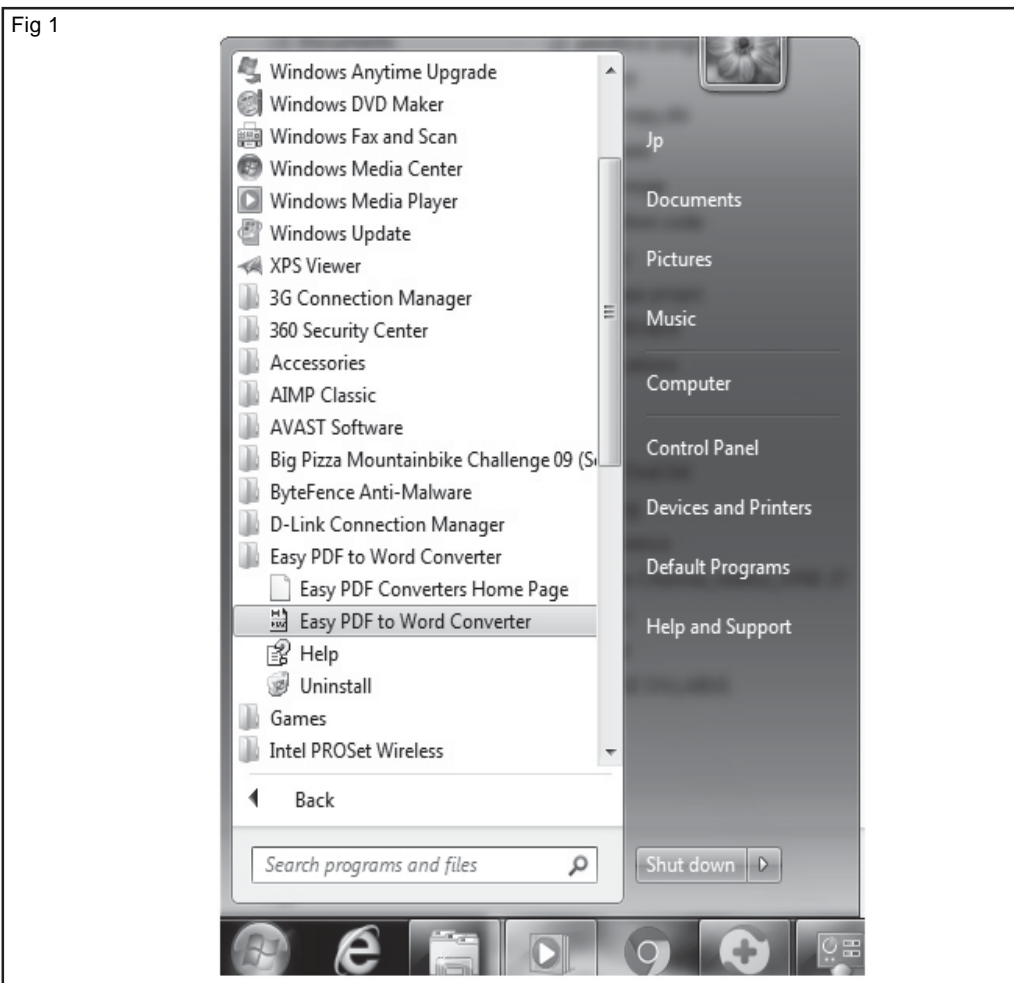• **Convert PDF file into word file.**

Requirement
Tools/Equipments/Instruments

- Desktop Computer or Laptop   - 1 No
  Software
- Software PDF to word
  converter   - as reqd

PROCEDURE
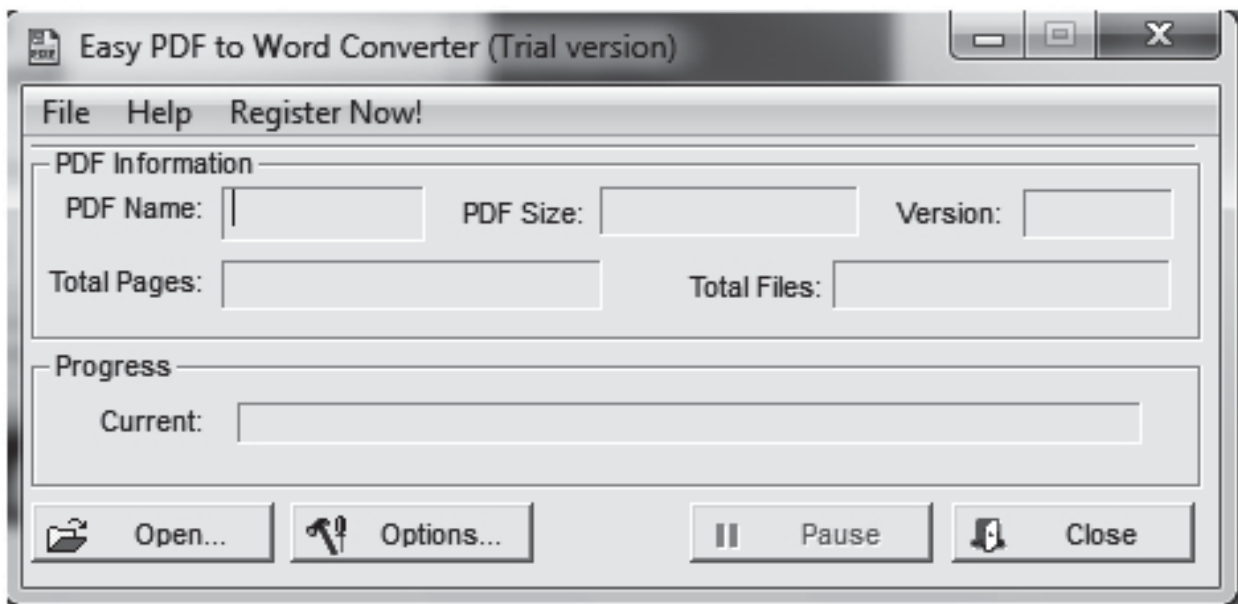
TASK 1 : **Converting the PDF file into Word file**

1   Click start button in desktop window

2   Select Easy PDF to Word converter in the program
list

3   Click Easy PDF to Word converter as shown in Fig 1.

Fig 1

The PDF to Word converter window appear as shown in Fig 2.

Fig 2

4 Click file menu and click open menu item in the window as on Fig 3.

Fig 3
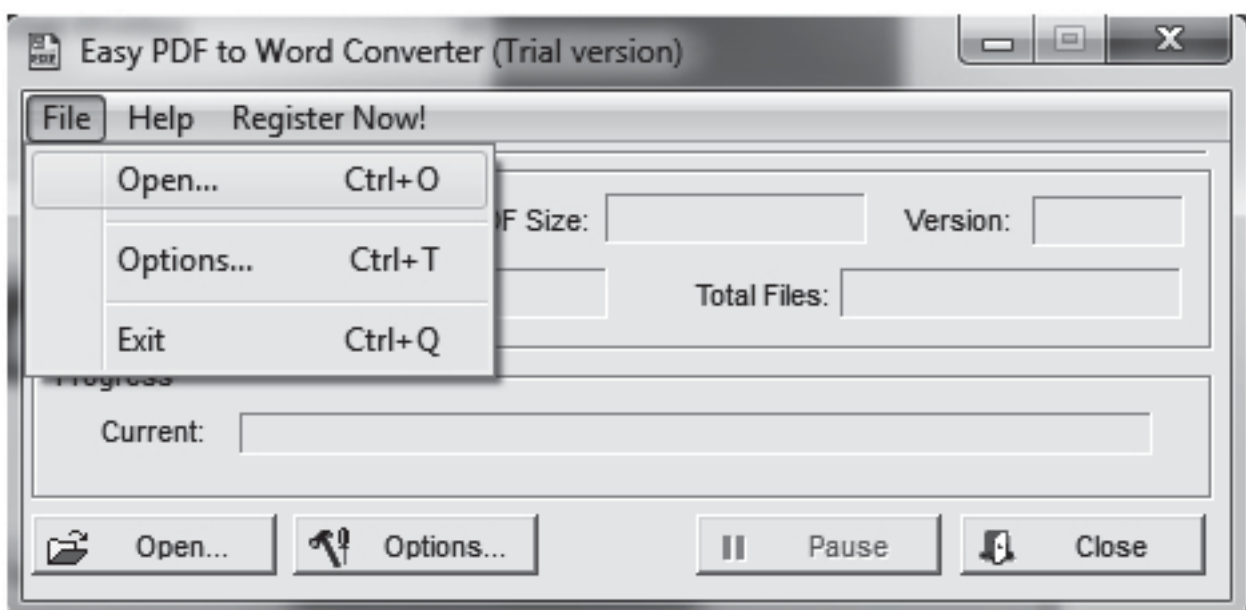
The open dialog window will display as on Fig 4, in the dialog box select any low size PDF file and press open button, suddenly the save dialog box also will appear.
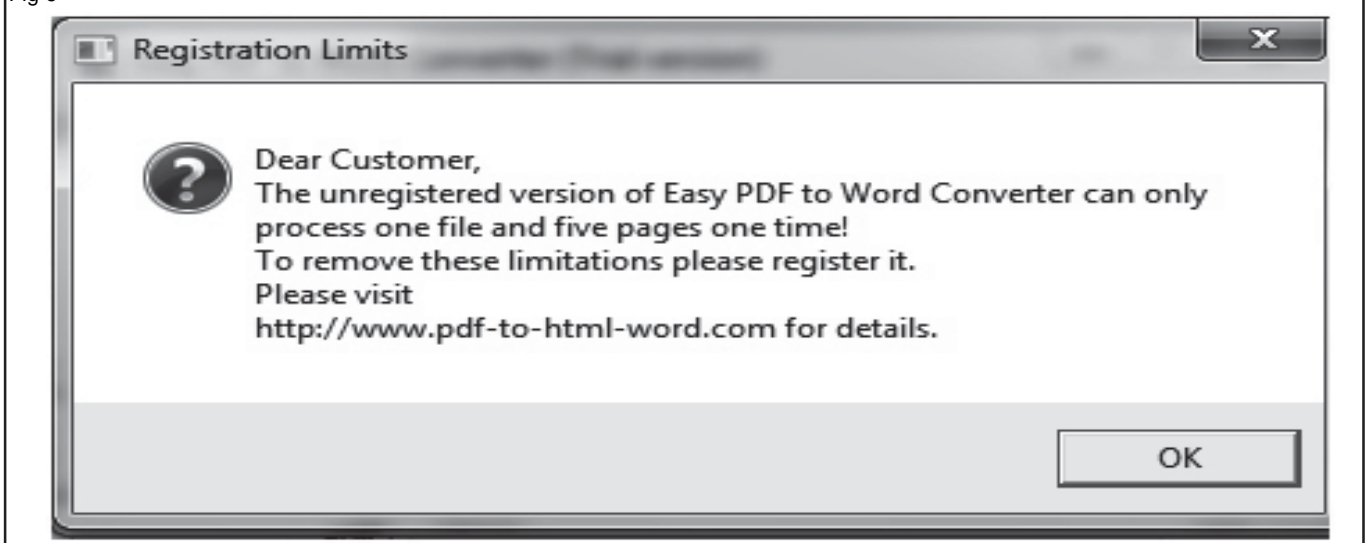
Fig 4
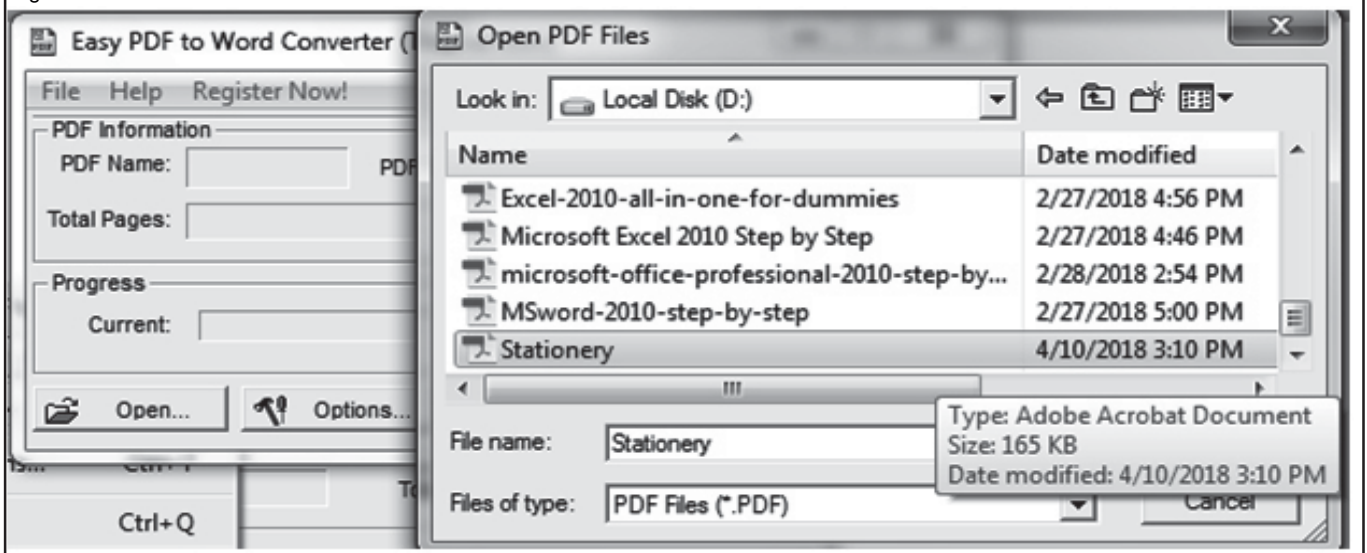
5 Type the file name and click save any drive as shown in Fig 5.

Fig 5
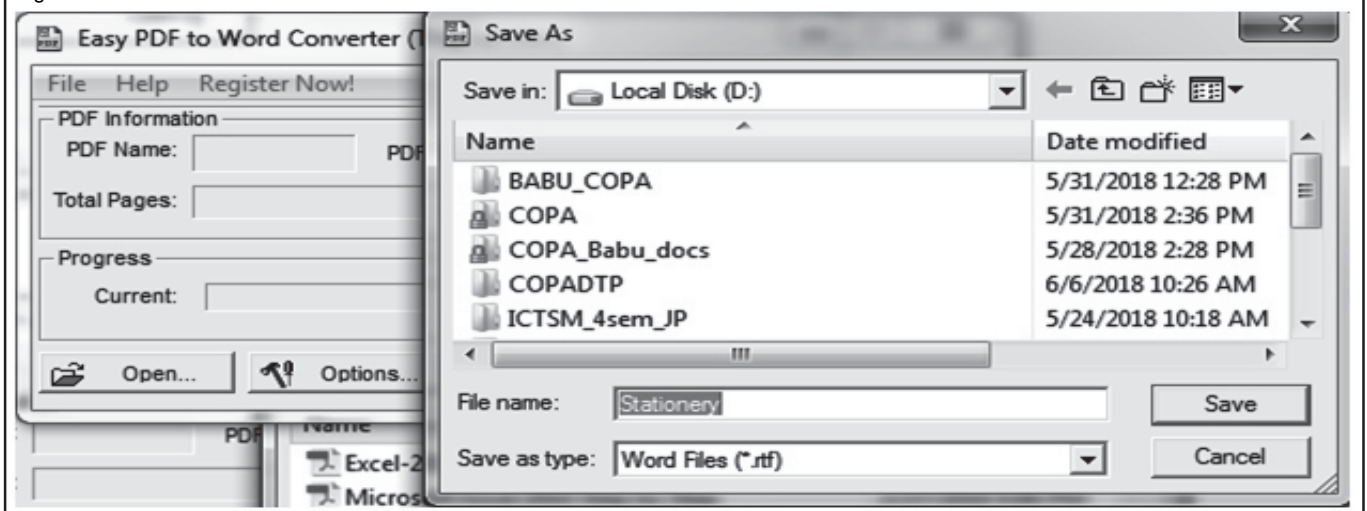
After converting to PDF file, the warning message will display as shown in Fig 6.

Fig 6

Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients

Objectives: At the end of this exercise you shall be able to
• **open yahoo website**
• **open google website**
• **open dictionary website**
• **download the image**
• **download software**
• **create mail account**
• **open the mail account**
• **compose mail**
• **check the inbox.**

Requirement
Tools/Equipments/Instruments
• Desktop Computer or Laptop with windows OS   - 1 No • Internet Connection

PROCEDURE

TASK 1 : **Opening the Yahoo Website**

1   Boot the system, if not booted.

2   Check the internet connection.

3   Double click the internet explorer on the desktop or

4   Choose Start button as in Fig 1.

Fig 1

5   Select Programs as in Fig 2.

Fig 2

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6   Click Internet Explorer

7   Opened internet explorer window

8   Type the website address : www.yahoo.com on address bar as in Fig 3.

9   Displayed yahoo web site.

10 Get the work checked by the Instructor.

Fig 3

— — — — — — — —

TASK 2 : **Opening the Google**

1   Type the address : www.google.com on address bar as in Fig 4

2   Displayed google website.

3   Get the work checked by the Instructor.

Fig 4

— — — — — — — —

TASK 3 : **Opening Dictionary.com website**

1   Type the address : www.dictionary.com on address bar as in Fig 5

2   Displayed dictionary website.

3   Get the work checked by the Instructor.

Fig 5

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.92   **157**

TASK 4 : **Downloading a Picture**

1 Type the address : www.google.com on address bar as in Fig 6.

2 Type the word "Flowers" on text box.

Fig 6

3 Click Images tab.

4 Click Search image button.

5 More flower images are displayed.

6 Click any one image.

7 Opened the flower image.

8 Select the flower image and right click the mouse button.

9 Click Save Picture as in Fig 7.

Fig 7

10 Choose saving location

11 Click Save button

Download Child Image

12 Type the address www.yahoo.com on internet explorer address bar

13 Displayed yahoo website

14 Type the word child Image on text box and click search tab

15 Choose images tab

16 More child images are displayed

17 Choose any one image

18 Double click the image

19 Select the image and Right click the mouse button

20 Click Save picture as in Fig 8

Fig 8
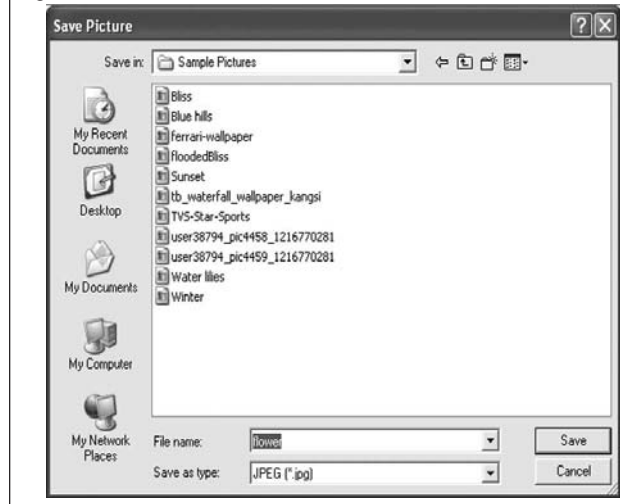
21 Choose saving location on image.

22 Click Save button.

23 Get the work checked by the Instructor.

— — — — — — — —

TASK 5 : **Downloading the Software**

1 Type the text google.com on internet explorer address bar.

2 Display the google website.

3 Type the text "download winzip software" on text box.

4 Click Search button.

5 More download link displayed.

6 Click any one link.

7 Click Download.

8 Choose saving location.

9 Click Saved button.

10 Get the work checked by the Instructor.

— — — — — — — —

TASK 6 : Creating a new mail account

1 Type the text **www.gmail.com** on internet explorer address bar

2 Open gmail website.

3 Click Sign up for Gmail link.

4 Open the Application window.

5 Fill all the columns.

6 Finally click I accept button.

7 Created your own gmail account.

8 Get the work checked by the Instructor.

— — — — — — — —

TASK 7 : Opening the Mail

1 Type the text www.gmail.com on internet explorer address bar.

2 Open gmail website.

3 Type the user name and password.

4 Click Sign in button.

5 Open mail window.

6 Check Inbox.

7 Inbox means received mail.

8 Get the work checked by the Instructor.

— — — — — — — —

TASK 8 : Composing email

Step 1

1 Click Compose mail button.

2 Display writing mail window.

3 Type the To address : example **rajesh_143@rediffmail.com**

Step 2

4 Type the Subject : example : Reg. Leave request.

5 Click Attach a file option.

6 Choose location for attached file.

7 Click Open button.

8 Display message.

9 Type the body text.

10 Check the spelling.

11 Finally click send button.

12 Click Sent mail option.

13 Displayed sending mail report.

14 Get the work checked by the Instructor.

— — — — — — — —

TASK 9 : Checking Inbox

1 Check Inbox button

2 One mail received is notified by inbox(1).

3 From address rajesh kannan

4 Click the latest mail.

5 Mail will be displayed.

6 Get the work checked by the Instructor.

— — — — — — — —

TASK 10 : Creating a New Mail account in Yahoo site

1 Type the address www.yahoo.com on internet explorer address bar

2 Open yahoo web site

3 Click mail option.

4 Open email window

5 Click signup link.

6 Display application window

7 Compulsory Fill all column your details.

8 Finally click these button " create my account"

9 Display window for account created.

10 Get the work checked by the Instructor.

— — — — — — — —

TASK 11 : Entering the yahoo mail

1 Type the mail id and password

2 Click Sign.

3 Enter the mail account

4 Check Inbox button (received 1 mail).

5 Check Spam mail (received 1 mail)

6 check online user.

7 Check Trash

Check the Inbox

8 Check the inbox button (1 mail received)

9 Click inbox

10 Display mail message

11 Get the work checked by the Instructor.

— — — — — — — —

TASK 12 : **Replying the mail**

1 Click the Reply link.

2 Display the compose window.

3 Automatically typed sender mail address.

4 Automatically subject typed sender subject.

5 Only typed message.

6 Finally click Send button.

Removed your Mail

7 Click received mail check box.

8 Click Delete button.

9 Deleted your current selected mail.

10 Displayed window for only one mail balanced.

Check Contacts

11 Click Contacts link.

12 Displayed all contacts name.

13 Get the work checked by the Instructor.

— — — — — — — —

TASK 13 : **Creating a New Folder**

1 Choose My Folder window.

2 Click Add link (right side).

3 Created folder name by default in untitled.

4 Type the folder name "Personal".

5 Folder "Personal" is created.

6 Get the work checked by the Instructor.

— — — — — — — —

TASK 14 : **Renaming the Folder**

1 Select the Folder.

2 Right click the mouse button

3 Click Rename option.

4 Type folder name.

5 Get the work checked by the Instructor.

— — — — — — — —

TASK 15 : **Deleting the Folder**

1 Select the Folder.

2 Right click the mouse button.

3 Click Delete option.

4 Deleted the selected folder.

5 Get the work checked by the Instructor.

— — — — — — — —

TASK 16 : **Moving to Folder**

1 Select the received mail.

2 Click the check box.

3 Click the Move button.

4 Displayed all created folder.

5 Select personal folder.

6 Moved to personal folder successfully.

7 Displayed message for There are no messages in the inbox folder.

8 Check the personal folder.

9 Successfully moved to personal folder one mail.

10 Get the work checked by the Instructor.

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.92

Identify different types of cables and network components e.g. Hub, switch, router, modem etc

Objectives: At the end of this exercise you shall be able to
• **identify the cable types**
• **identify the network components.**

Requirements

Tools/Equipments/Instruments		Materials/Components	
• Modem	- 1 No	• Coaxial cable bundle	- as reqd
• Hub	- 1 No	• UTP cable bundle	- as reqd
• Router	- 1 No	• STP/optical cable	- as reqd
• Switch	- 1 No		

> **Note: The instructor has to select various network cables for this exercise and label them using numbers.**

PROCEDURE

TASK 1 : **Identification of different types of cables**

1 Pick one of the labelled cable from the given lot and identify the types.

2 Record the observations in the table 1 (Refer to the Chart-1 to identify the name of the cable).

3 Repeat the steps 1 of 2 for remaining labelled cables.

4 Get the work checked by the Instructor.

Table 1

Sl. No.	Label No	Type Name	Remarks
1			
2			
3			
4			
5			

Chart - 1

Various network cables	Name of the cable

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TASK 2 : **Identification of various devices used in networking.**

1　Follow the steps in task 1 (instead of cable use labelled network devices/components)

2　Refer chart- 2 and record the observation using table 2.

3　Repeat the steps for remaining labelled devices.

4　Get the work checked by the Instructor.

Table 2

Sl. No.	Label No	Type/Name of device/ components	Remarks
1			
2			
3			
4			

Chart 2

Various devices used in networking	Name of the device

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.93

Prepare terminations, make UTP and STP cable connectors and test

Objectives : At the end of this exercise you shall be able to
• **prepare a UTP cross cable ends for making connection to the computer**
• **test the cable with LAN tester.**

Requirements		
Tools/Equipments/Instruments		**Materials/Components**

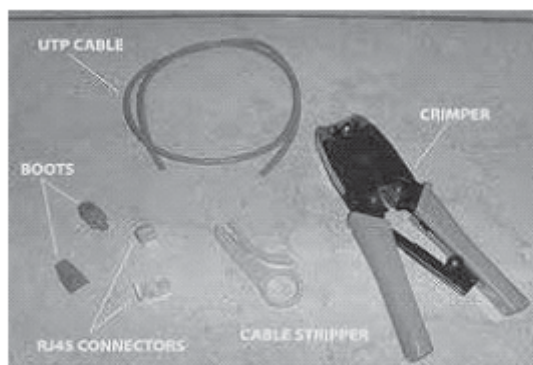|		
• Desktop computers	- 2 Nos	• RJ - 45 - 1 No
• Crimping tool	- 1 No	• RJ - 11 - 1 No
• LAN tester	- 1 No	

PROCEDURE

TASK 1: **Prepare a UTP cross cable ends for making connection to the computer**

The instructor has to arrange the required length of cross cable, the tool for crimping and two computer for making connection as shown in Fig 1.

Crimp tools have two blades. One designed to cut the cable and other to strip the jacket. While stripping the cable care should be taken not to cut the internal wires. Remove the jacket insulation about an inch. When the jacket insulation removed you will find eight wires twisted into four pair for CAT 5 cable as in Fig 3a and a separator inside the CAT6 cable as shown in Fig 3b.

Fig 1

1 Use crimping tool as shown in Fig 2 to cut through a cable and strip the cable jacket/insulation using cable stripper/crimping.
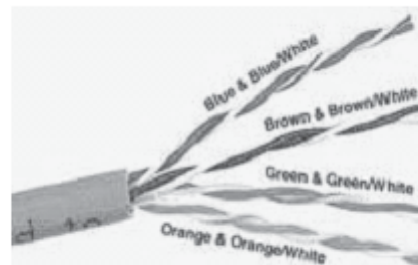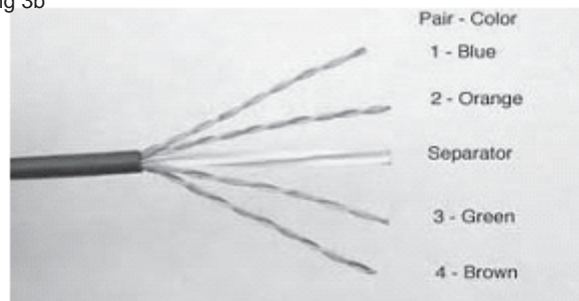
Fig 3a

Fig 2

Fig 3b

2 Cut the separator off and untwist the wires back to within one-eighth inch of the jacket.

3 Arrange the wires from left to right in the order they are to be crimped. The normal crimping order for cross cable is shown in Fig 4a & Fig 4b.

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- Cross over cable
- One end

Fig 4a


```
1  White-Green
2  Green
3  White-Orange
4  Blue
5  White-Blue
6  Orange
7  White-Brown
8  Brown
```

Fig 4b


```
1  White-Green
2  Green
3  White-Orange
4  Blue
5  White-Blue
6  Orange
7  White-Brown
8  Brown
```
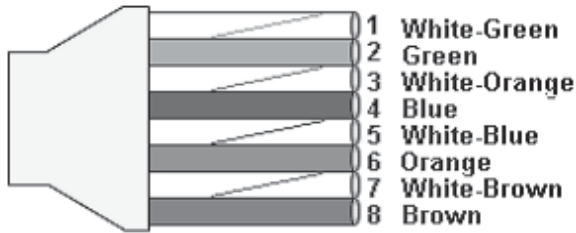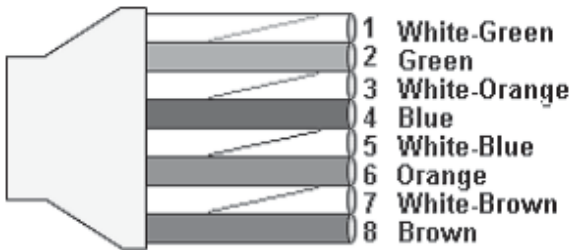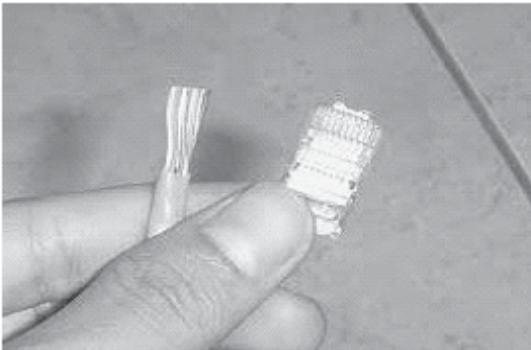
4 Grasp the wires firmly between your fingers and flatten them to remove the curliness

The wires must lay flat and together aligned as closely as possible in order. when finished the cable should look like as shown in Fig 5.

Fig 5

5 Cut a few mm while holding them firmly, so they are all of the same length as shown in Fig 6.

6 Slide the RJ45 connector on to the wires making sure the wires stay lined up

Fig 6
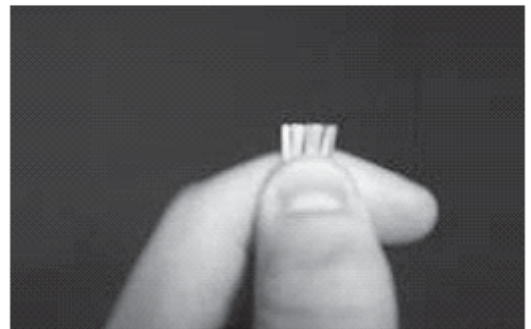
Try to make each wire fits in the slot of the connector and make each wire reach the end of its slot. The cable jacket/insulation should reach just beyond the end of the crimp point as shown in Fig 7.

Fig 7

7 Verify all the wires are in the correct order, and insert the connector in to the crimping tool and press to crimp as shown in Fig 8

Fig 8
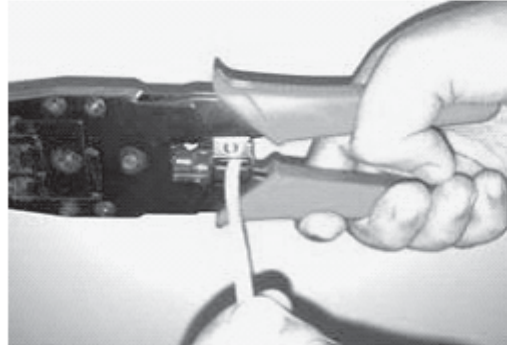
Now half of the work done. The cable should look like as shown in Fig 9. The process must be repeated for the other end of the cable. However the colour code wiring order changes for cross cable as shown in Fig 10.

Fig 9

Fig 10

1 Green White

2 Green

3 Orange White

4 Blue

5 Blue White

6 Orange

7 Brown White

8 Brown

Similarly straight through cable and roll over cable can be prepared with the help of the instructor. The colour code wiring order is shown in Fig 11.

Cross over cable is used to connect between two hosts (PC's). Straight-through cable is used in network when connecting a host to a switch. A rollover cable is used in a networking environment where a outer/switch is to be conf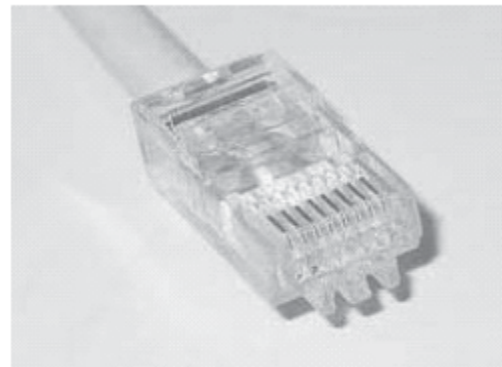igured from a computer. One end is wired one way but on the other it is reversed. You would typically use on end into a serial port on a PC and the other into the console port of the switch/router

Fig 11

Straight-Through Cable | Rollover Cable

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8   8 7 6 5 4 3 2 1

TASK 2: **Testing the cable with the LAN tester**

1 Insert one end of the cross cable (prepared in Task 1) into one socket and other end in another plugged in socket of the LAN tester as shown in Fig 12

Fig 12

Check for the batteries loaded in cable tester

2 Switch 'ON' the LAN tester.

3 Note the order in which LED's glowing in both the panel of the LAN tester should correspond to the order shown in Fig 13

If the LED's doesn't glow, then there is a break in the cable.

Fig 13

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.94

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Connect network connectivity hardware and check for its functioning

Objectives : At the end of this exercise you shall be able to
* **check NIC installed**
* **install NIC CARD**
* **connect LAN Chord**
* **check functionality of network.**

Requirement
Tools/Equipments/Instruments
• Desk top computer or Laptop   - 1 No • NIC card installation   - 1 No

PROCEDURE

TASK 1 : **Checking whether NIC is installed in Desktop or not**

1   Open whether NIC Card is installed in Desktop

2   Click on the Network Adapters and check the
    availability of the NIC card
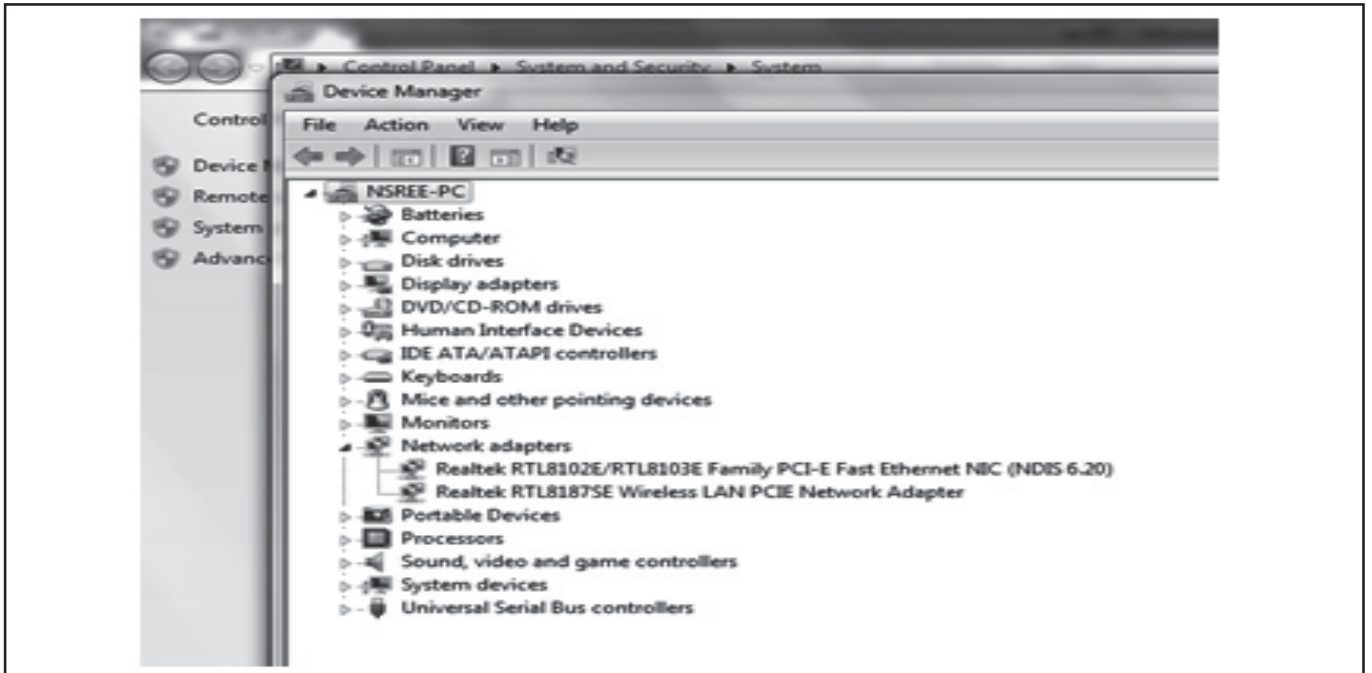
3 Right Click on the NIC Card if available and check properties
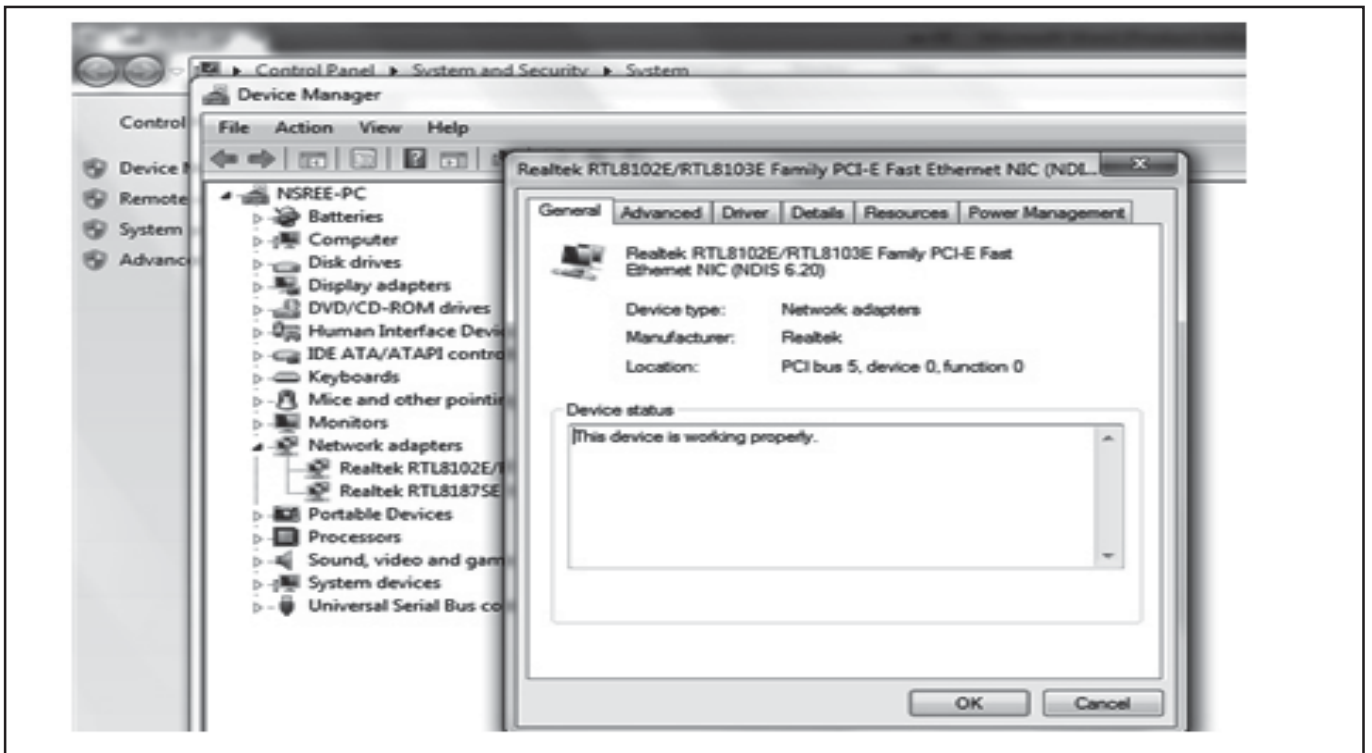
4 Close all the opened windows on successful checking.

5 Get the work checked by the Instructor.

TASK 2 : **Installation of NIC Card if not installed**

1 Insert the CD/DVD containing NIC Card driver Information (or) Download the relevant driver for NIC card from Internet

2 Confirm the make of the NIC card and driver using internet checking tools

3 Click setup.exe in the drivers folder to install the NIC card.

4 Finish on successful installation.

5 Check the card is installed properly using Device Manager, as it has no yellow or question mark near the device.

6 Re-install using the 'Search for Drivers using Internet' to find a proper driver automatically.

7 Get the work checked by the Instructor.

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.9.95 **167**
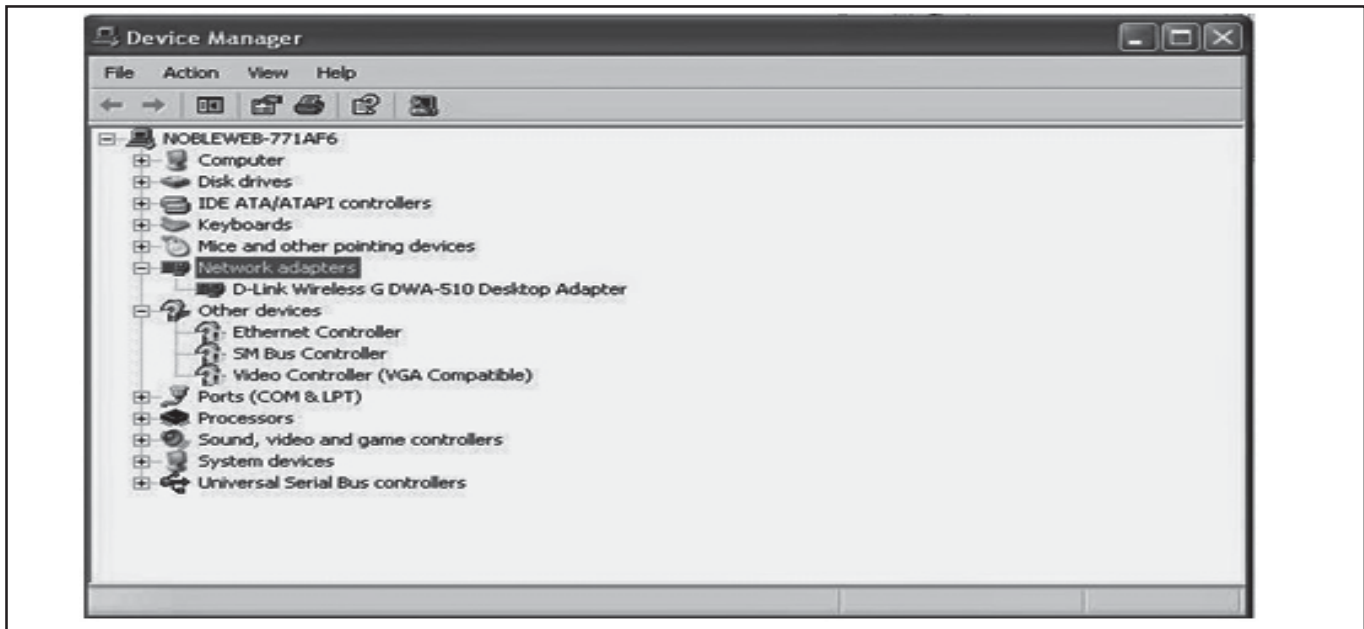
TASK 3 : **Connecting the LAN card and establish network connection**

1 Plug one end of the NIC Card in the Desktop LAN Port (Ethernet Port).

2 Plug the other end into the Switch / Hub / NIC Point available.

3 Confirm the Desktop LAN Port shows a green light, which confirms the connection is successful.

4 Preview the LAN details for TCP/IP settings to access the internet from the LAN using the command in Start -> Run -> command ->ipconfig.

TASK 4 : **Checking the functionality of network**

1 Click on Chrome / Firefox logo to open the browser.

2 Type http://www.google .com in the address bar and wait for opening the Google web page.

> **Note : If the google page appears, internet is connected successfully. If it is not showing and displays as page cannot be displayed, internet is not connected.**

3 Setup a Local Network to connect with other computers using Setup a Home Network in the control panel-> Network Setup wizard.

4 Create the workgroup setup to connect with the network computers.

5 Set values for IP address, file sharing options to connect and share the system information.

6 Get the work checked by the Instructor.

Configure a wireless Wi-Fi network

Objectives: At the end of this exercise you shall able to
• **Check Wi-Fi hardware**
• **Connect Wi-Fi network**
• **Disconnect Wi-Fi network.**

Requirements
Tools/Equipments/Instruments
• Desk top computer or Laptop — - 1 No • wifi hardware installation — - 1 No

PROCEDURE

TASK 1 : **Checking the availability of the wifi hardware and installation**

1 Open the control panel and check the Network adapters for the Wi-Fi.
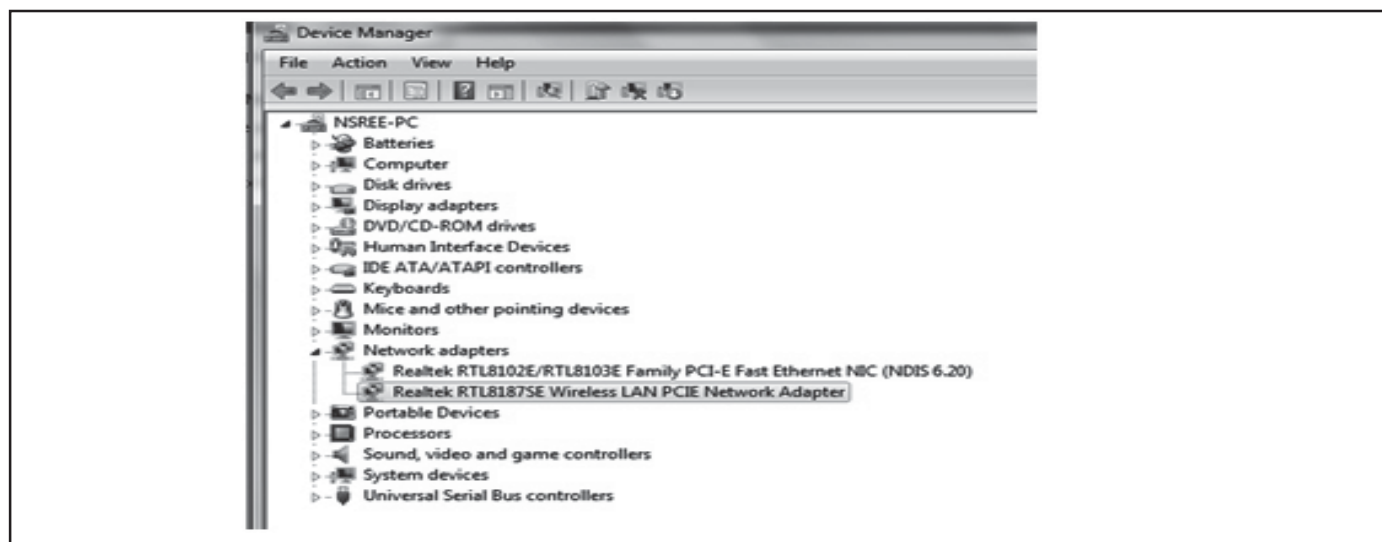
2 Check the proper working of Wi-Fi device using properties.

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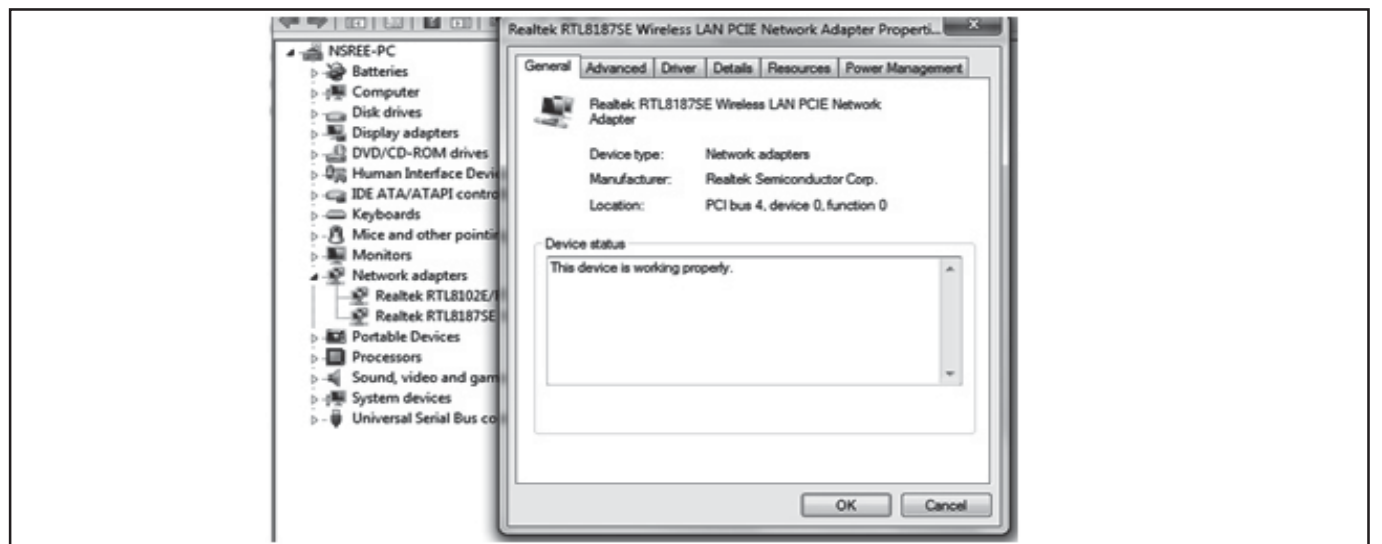
3 Install a device if not found in the system as external Wi-Fi dongle.

TASK 2 : **Connecting a Wi-Fi network**

1 Click the wireless icon in the notification area.

2 Select the network to connect.

3 Check the Connect automatically option.

4 Click the Connect button

5 Enter the network security key.

— — — — — — — —

TASK 3: **Disconnecting of Wi-Fi network**

1 Click the wireless icon in the notification area on the task bar.

2 Select the network that is currently connected.

3 Click the Disconnect button on the network connection.

4 Get the work checked by the Instructor.

4 Install driver for the device using CD or Internet download.

5 Check in the device manager for successful installation.

6 Get the work checked by the Instructor.

6 Click the Next button.

> **Note :If the network flyout is not reporting any wireless network, try the steps shown below to turn off and on again Wi-Fi to see if that fixes the problem.**

7 Get the work checked by the Instructor.

> **Note :Alternatively, click the quick action Wi-Fi button at the bottom to turn off the adapter and disconnect from the network using flyout menu.The same Wi-Fi button can also be found in the Action Center's Quick Actions section (Windows key + A).**

— — — — — — — —

Construct and test a +12V fixed voltage regulator using 3 terminal regulator IC

Objectives : At the end of this exercise you shall be able to
• **construct and test a +12V regulator using IC 7812.**

Requirements

Tools/Equipments/Instruments

• DC Regulated power supply
  0-30 V/2A   - 1 No
• Trainees tool kit   - 1 Set
• DC ammeter, 0-1A   - 1 No
• Digital multimeter with probes   - 1 No
• Rheostat 100Ω/1A   - 1 No

Materials/Components

• Breadboard   - 1 No
• Three-pin voltage regulator
  IC 7812 or equivalent   - 1 No

• Suitable heat sink for IC 7812   - 1 No
• Capacitor 270 nF, disc/25V   - 1 No
• 10 µF/25 V, electrolytic   - 1 No
• Red LED/5mm   - 1 No
• Resistor 820Ω, ¼W CR25   - 1 No
• Hook up wires (red and black colour) - 1 m
                                        each
• Wire sleeves (R,Y,G)   - 2 cm
                                        each
• Rosin cored solder   - 10 gm

PROCEDURE

1 From the type code marked on the given 3 pin regulator IC. Identify the terminals of IC 7812.

2 Insert sleeves to the terminals using colour coding scheme given below;

   Input - Yellow/Orange sleeve.

   Common - Green/Black sleeve.

   Output - Red sleeve.

3 Get the work done in steps 1 and 2 checked by the instructor.

4 Fix the suitable aluminium heat sink for IC 7812 on the bread board Refer Fig 2 for the position of heat sink on the breadboard.

5 Construct the voltage regulator circuit referring to the schematic and layout diagram shown in Fig 1 & Fig 2.

Fig 1

+12V FIXED OUTPUT VOLTAGE REGULATOR CIRCUIT
SPEC:OUTPUT DC:12V,RATED MAX LOAD 800mA

Fig 2

CODE NO: 111 - 05 - TB
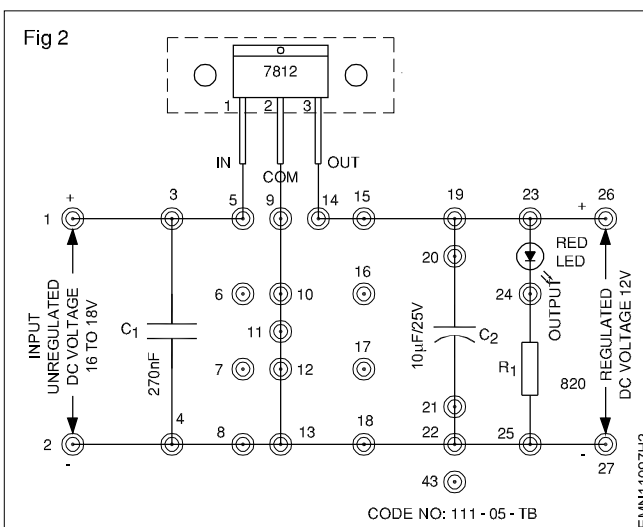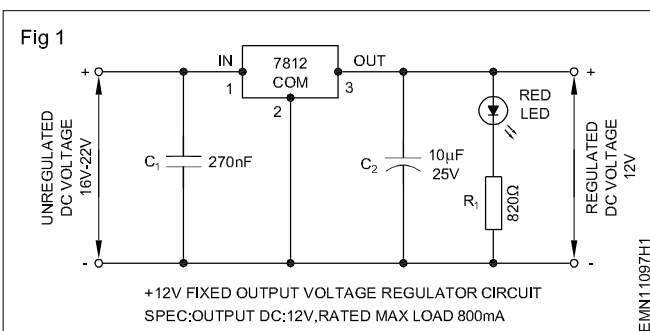
6 Get the neatness and correctness of your wiring checked by your instructor.

7 Apply 16 to 20 volts unregulated dc voltage to the input of the wired 12V regulator. Record the unregulated input voltage and no-load output voltage of the regulator in O & T sheet.

The unregulated dc voltage to the regulator should not be more than 24 volts; otherwise the IC may get damaged.

8 Using loading rheostat, load the regulator in steps of 200 mA upto 800mA and at each step measure and record,

- Regulated dc output voltage

- Input and output ripple.

> Loading is limited to 80% of its rated maximum of 1A. This is because the heat sink used with IC 7812 may not be very effective in transferring away the heat.

9 From the recorded readings, calculate the

– output voltage regulation at each step of loading.

– ripple rejection at each step of loading.

10 Get the work checked by the Instructor.

O & T Sheet

1 Neatness and correctness of wiring: **Very good**   **Good**   **Satisfactory**   **Poor**   **Continue Exercise**

☐   ☐   ☐   ☐   ☐

2 Level of unregulated input voltage to the regulator : _____

	No-load	Load - Current			
		200 mA	400 mA	600 mA	800 mA
Output voltage					
Input ripple (P-P)					
Output ripple					
Ripple rejection					
Output regulation					

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.10.97

Identify the different types of fixed +ve and -ve regulator ICs and the different current ratings

Objectives : At the end of this exercise you shall be able to
• **construct and test a +12 volts regulator to get a variable output regulation.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Semi conductor data book	- 1 No
• Multimeter/DMM with probes	- 1 No

Materials/Components

• Different types of -ve and +ve regulator ICs (78/79 series)	- 10 Nos

Note: The instructor has to label the different types of fixed positive and negative regulator ICs.

PROCEDURE

TASK 1 : **Identification of different types of fixed positive and negative voltage regulator ICs**

1 Pick one of the labelled IC regulator from the lot, identify the code number and other details and record the observations in Table 1.

2 Refer the semiconductor data manual and verify the details of the IC regulators, compare and record in Table 1.

3 Repeat the steps 1 and 2 for the remaining labelled IC regulators and record the observation and note down in Table 1.

4 Get the work checked by the Instructor.

Table 1

Sl.No.	Label No.	Type of regulators (+ve/-ve)	Voltage rating	Current rating	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

— — — — — — — —

Identify different heat sinks for IC based regulators

Objectives : At the end of this exercise you shall be able to
• **identify the different +ve and -ve regulator ICs**
• **Identify the types of package**
• **Identify the different heat sinks for regulators ICS.**

Requirements

Tools/Equipments/Instruments		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Different types of heat sinks	
• Multimeter/DMM with probes	- 1 No	used for IC regulators	- as reqd
• Semi conductor data manual	- 1 No		

Note: The instructor has to label the different types of heatsinks used for IC regulators.

PROCEDURE

TASK 1 : **Identification of different types of heat sinks used for IC based regulators**

1 Pick any one of the labelled heatsink from the lot, identify the type and record in Table 1.

2 Refer to the chart 1 and verify the details of different types of heatsinks and record in Table 1.

3 Repeat the steps 1 & 2 for the remaining labelled heatsinks and record it in Table 1.

4 Get the work checked by the Instructor.

Table 1

Sl.No.	Label No.	Regulator type	Suitable heat sink type	Remarks
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

— — — — — — — — —

Observe the output voltage of different IC 723 metal / plastic type and IC 78S40 regulators by varying the input voltage with fixed load

Objectives : At the end of this exercise you shall be able to
• **observe the output voltage of IC 723 and IC 78S40 regulators.**

Requirements

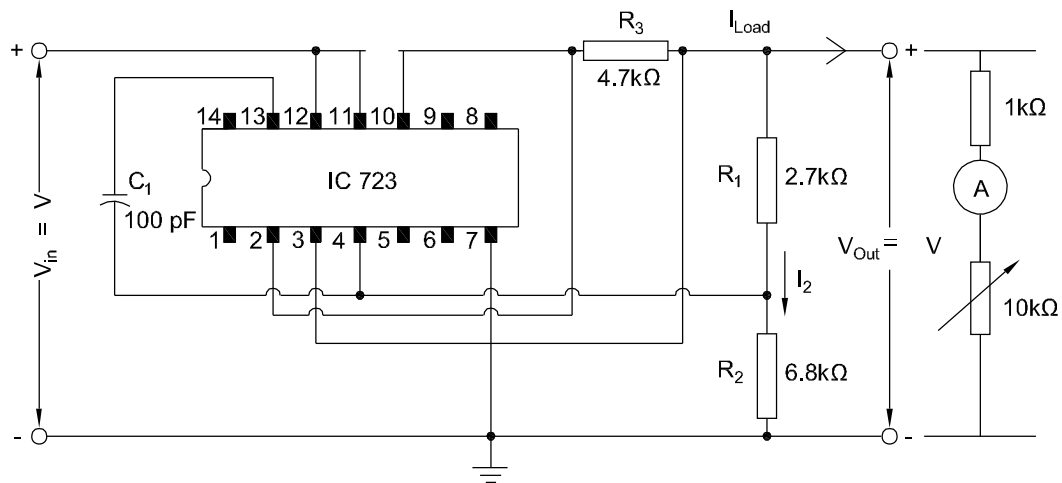| **Tools/Equipments/Instruments**		**Materials/Components**	
• Trainees tool kit	- 1 Set	• Breadboard	- 1 No
• Soldering Iron 25W/240VAC	- 1 No	• IC 723	- 1 No
• Digital multimeter with probes	- 1 No	• Capacitor 100PF	- 1 No
• Ammeter	- 1 No	• Resistor 1kΩ/½W	- 1 No
		• Resistor 2.7kΩ/½W	- 1 No
		• Resistor 6.8kΩ/½W	- 1 No
		• Resistor 4.7kΩ/½W	- 1 No
		• 10Ω Potentiometer/1A carbon type	- 1 No

PROCEDURE

1 From the type code marked on the given 14 pin positive regulator IC.

2 Identify the pins of IC 723 and insert sleeves to the terminals using colour coding scheme given below

Input Yellow / Orange Sleeve

Output Red sleeve

Earth - Green / Black sleeve.

3 Construct the voltage regulator circuit referring to the schematic circuit diagram shown in Fig 1.

4 Get the neatness and correctness of the wiring checked by the instructor.

5 Apply regulated dc voltage to the input of the wired regulator. Record the output voltage of the regulator in Table 1.

6 From the recorded readings. Calculate the output voltage regulation at each step and plot the graph.

7 Get the work checked by the Instructor.

Table 1

S No.	Input voltage (V_i) in Volts	Output voltage in volts (V_o) in Volts
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Fig 1

Fig 2

LINE (or)INPUT
VOLTAGE IN VOLTS

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.10.100

Construct and test a 1.2V to 30V variable output regulated power supply using IC LM317T

Objectives : At the end of this exercise you shall be able to
• **construct and test a 1.2 V to 30 V variable output regulated power supply.**

Requirements

Tools/Equipments/Instruments

• Trainees tool kit	- 1 Set
• Soldering Iron 25W/230V	- 1 No
• Digital multimeter with probes	- 1 No
• Rheostat 100Ω/1A	- 1 No

Materials/Components

• Breadboard/PCB	- 1 No
• Step down transformer, 240V/24V or 12-0-12/24V	- 1 No
• Diodes, 1N4002 or BY127 or Eqv	- 6 Nos
• Capacitors 2200 µF/50V electrolytic	- 1 No

|	
25 µF/50V, electrolytic	- 1 No
10 µF/50V, electrolytic	- 1 No
100 nF, ceramic disc	- 1 No
• LED, Red, 5mm	- 1 No
• Resistors	
4K7, potentiometer, carbon, rotary	- 1 No
2K2, carbon, ½W	- 1 No
220Ω, carbon, ¼W	- 1 No
• 3-terminal voltage regulator, LM317T, TO-220	- 1 No each
• 1A, slow blow fuse with fuse holder	- 1 No.
• Hook up wires	- as reqd
• Rosin cored solder	- 20 gm
• Heat sink for TO-220 package	- 1 No

PROCEDURE

1 Test all the components to confirm their good working condition. Record the specifications of IC LM317T in O&T sheet, refer with semi conductor data manual.

2 Check the given bread board.

3 Construct a variable regulated output power supply on the given bread board referring to the schematic shown in Fig 1.

> **All components except the transformer to be mounted on bread board. Use suitable heatsink with IC 317 T.**

5 Get the correctness and neatness of wiring checked by the instructor.

6 Diagram connect the secondary of (230/24V) transformer to the assembled circuit. Switch ON mains supply.
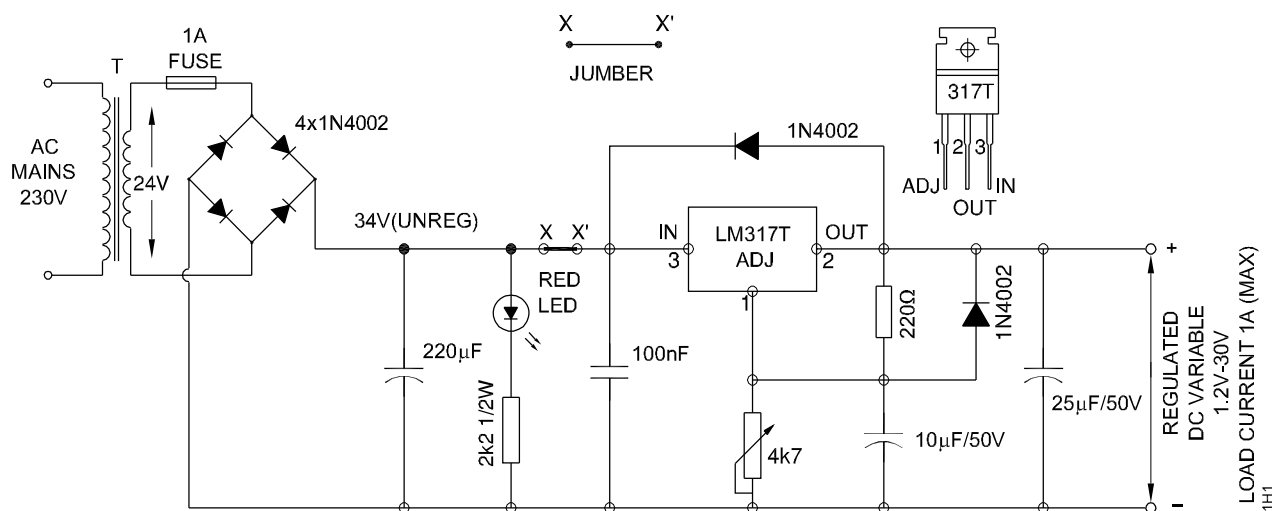
NOTE: INSERT ALL COMPONENTS EXCEPT THE FUSE & TRANSFORMER ON THE BREAD BOARD

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Switch OFF main supply immediately if burning, smoking overheating, sparks are observed in any of the components, and report to the instructor. Check the IC and ensure that it is not heated-up

7 Measure and record the unregulated dc input and the minimum, maximum variable voltage of the regulator under no-load condition.

8 Set the output to +15 volts and load the output using a loading rheostat in steps of 200 mA up to 600 mA. In each step measure and record the output voltage and the ripple voltages.

Load current is restricted to 600mA as heat-sink is provided to the IC may not be the ideal one.

9 Calculate and record the output regulation and ripple rejection of the regulator.

10 Using a dc current meter (0-1A range) short the load terminals momentarily and record the *short circuit fold back protection* current level.

11 Get the readings checked by the instructor.

Lab Assignment: Mount the regulator IC on a good aluminium heat-sink (available in market). If a good heat-sink is used with the IC, you can draw upto 1Amps easily. Mount the transformer and the wired PCB in a metallic box of suitable size. Mount the POT on the front panel of the box made. Mount output terminal sockets (Red and black) on the front panel of the box from which DC voltage can be taken. This will serve you as a 1.2V to 30V, 1A rating variable power supply for servicing circuits in forthcoming exercises as well for the hobby gadgets and general servicing.

Table 1

Type number	Package type	Output voltage		Max. output current
		Min.	Max.	

1 **Specification of the given 3-terminal regulator IC.**

2 **Neatness and correctness of wiring:** Very good Good Satisfactory Poor Continue Exercise

☐   ☐   ☐   ☐   ☐

3

Unregulated dc input to regulator   : _____

Minimum adjustable output voltage (No-load)   : _____

Maximum adjustable output voltage (No-load)   : _____

4

Set output voltage : 15 volts

Load current	200mA	300mA	400mA	500mA	600mA
Output voltage					
Output ripple (p-p)					
Input ripple					
Output regulation					

— — — — — — — —

Electronics & Hardware: Electronics Mechanic (NSQF Level - 5) - Exercise 1.10.101