VOCATIONAL HIGHER SECONDARY

FIRST YEAR

MAINTENANCE AND OPERATION OF
BIO MEDICAL EQUIPMENT COURSE
TEACHERS' SOURCEBOOK

GOVERNMENT OF KERALA
Department of Education

SCERT- 2005- '06

State Council of Educational Research & Training
Vidyabhavan, Poojappura, Thriuvananthapuram-12, Kerala

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Preface

Dear Teachers,

Based on the new awareness of the significant changes in learning process and in evaluation, activity based and process oriented pedagogy is being introduced in Vocational Higher Secondary Education.

As far as Maintenance and Operation of Biomedical Equipment course is concerned, its methodology has been conventionally activitybased. It is updated here to suit the present scenario.

This Sourcebook is prepared for equipping our teachers with the latest trends in learning activities like activitybased, learnercentred and also process oriented teaching strategies.

For the preparation of this Sourcebook, SCERT, Kerala, has recieved expertise from various fields like, Engineering, Paramedical Sciences, Agriculture, Commerce and Information Technology. The teachers can avail themselves of resources like, reference books and the internet for planning the activities as well as for better transaction and sucessful implementation of the curriculum.

May I hope that our concerted efforts will make an upsurge in the field of Vocational Education.

With regards,

Thiruvananthapuram

25. 11. 2005

Dr. E. Valsala kumar

Director

SCERT, Kerala

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1. INTRODUCTION

Vocationalisation means training in a particular vocation at the school. Secondary and Higher Secondary, and this vocational training may be of terminal stage. In the second sense vocationalisation means training in some vocation at the Higher Secondary stage along with General education. Vocationalisation of education has remained steadfast in the belief in the value of the practical aspect, not to the exclusion of other values, but with the point of view that man's contribution to society depends in a large measures upon the practical bend. The goal of this system is to orientate learners to a range f work occur in different vocations and to determine the range in response to various employment needs. This prepares ground for efficient workers for the fast developing country and on the otherhand develops diginity of labour in the learners.

The bookish character of our education was criticised by the Indian Education Commission and it categorically emphasised that unless education was directly linked with productivity. Education would remain a scholastic venture not very much concerned with national developments. So vocationalisation of education is a major thrust in the re construction of present educational system. It aim at equiping the learner with mannual skills founded on basic scientific principles as would be needed in todays society and with capacity to adopt overchanging scientific and technological developments. Another important objectives of vocationalisation is to provide enterprenures with special emphasis to the concerned vocation they have learned. Our state offers vocational education in various streams along with general education. These streams are engineering, Paramedical, Agriculture, Vettinary, Commerce, Tourism etc.

In modern medicine the paramedical wing has got a key role in diagnosing disceases as well as treatment. Now every day man is very much concerned about their health. So modern facilities for diagnosis and treatment becomes indispensable. Economic development accelerated the advancement of Technology but especially in modern medicine. This scenario the scope of modern biomedical equipments becomes an undeniable fact for physicians. "Better health care through technology" is the motto of Biomedical engineering. So skilled persons in this field is absolutely necessary. Inorder fulfil this aim VHSE offers MOBE curse in paramedical stream.

Maintenance and operations of Biomedical equipment course deals with basic electricity, basic electronics, Various electronic circuites, Measuring instrumetns and Bio-Medical instrumentation used in a hospital enviornment. After the course the learner will ahve the capability of operating variety of biomedical equipments like, ECG Machine, bedside monitors, EEG machine, EMG machie, X- ray machine, Analytical instruments like photoelectric colorimeter, spectrophoto meter, conductivitymeter, pH meter, Chloride meter and Audio meter. The learner get basic idea about Ultra sound scanning, Computed tomography, Magnetic Resources Imaging sysem. Medical ICU, Manifold and therapautic equipments. The curriculum also covers the application, calibration, underlying principles and maintenance of these equipments.

The main objective of this source book is to assist the teacher to transact the modified curriculum through learner centred and activity oriented strategies. The approach to the new curriculum has different perspective from the earlier approaches as to learner's nature, learning process, role of teacher the process of teaching and the process of evaluation.

2. GENERAL APPROACH

Introduction

The ultimate aim of education is human refinement. Education should enable the learner to formulate a positive outlook towards life and to accept a stand which suits the well being of the society and the individual as well.

The attitude and potential to 'to work' has determined the destiny, progress and cultural development of the human race. As we all are aware, the objective of education to form a society and individuals having a positive work culture. The educational process expected in and outside our formal schools should concentrate upon inculcating concepts, abilities, attitudes and values in tune with these 'work culture.' Hence vocationalised education cannot be isolated from the main stream of education. In anthor sense, every educational process should be vocationalised. However, due to our inability to utilise the resources wisely, scarcity of job opportunities is a severe issue of the present society. For overcoming this deep crisis, emergent techniques have to be sorted out and appropriate researches have to be seriously carried out. It is in the sence that the content and methodology of vocational Higher Secondary Education have to be approached.

The Vocational Higher Secondary course was envisaged as a part of the National Policy on Education with the noble idea of securing a job along with education. The relevance of Vocational education is very great in this age of un employment. This education system, which ensures a job along with higher education, stands aloof from other systems of education.

A learning environment which ensures vocational aptitude, vocational training, basic life skills, competencies related to different subjects, appropriate values and attitudes and existential readiness has to be provided here.

The curriculum should be one which recognises the specific personality of the learner and should develop it in a desirable way. It should provide opportunity to imbibe novel ideas to follow a critical approach and for learning through experiences.

The competency to transform ones own resources for the betterment of the society and the individual is to be ensured in each individual. Training in the sense of equality, democratic sense, environmental consciousness and devotion to the constitution is an inseparable factor of the curriculum.

The need of a systematic curriculum is prevailing in vocational subjects. A scientifically structured curriculum incorporating the unique features peculiarity of Kerala ensuring the possibility of higher education and utilising the national and international possibilities of employment is required.

The new curriculum should be capable of assimilating the life skills, scientific temper, attitude of coexistence, leadership qualities and mental health to face the challenges of life. It should be capable of strengthening the competencies imbibed by the learners up to the tenth class.

A curriculum for selecting vocational areas according to the aptitude of the students, learning it in depth, acquire general awareness in the basic areas and to secure jobs has become the social need of the day. A learner centered, process oriented, need based vocational curriculum is envisaged.

What is learning?

- Learning is construction of knowledge and so it is a live and continuous mental process.
- Learning is a process of advancement through adding and correcting in the light of comparing the new issue with the previously learned concepts.
- Learning takes place as a part of the effort to solve problems.
- Learning takes place by assimilating bits of knowledge into ones own cognitive structure.
- Learning is not a linear process. It is a spiral process growing deeper and wider.
- Learning is an intellectual process rather than the mere memorisation of facts. Learning is a conglomeration of a variety activities like problem analysis, elucidation, critical thinking, rational thinking, finding out co-relations, prediction, arriving at conclusions, applications, grouping for other possibilities and extracting the crux. When opportunities are provided for intellectual processes learning will become effective and intellectual ability will get strengthened.

Theoretical foundations of learning

Education is the best device that can be adopted for creation of a new society. It should be democratic in content and process and should acknowledge the rights of the learner. It should also provide opportunity for better citizenship training. The concept of equality at all areas should get recognition in theory and practice.

There should be conscious programme of action to develop nationality, humanness and love and against the encroachment of the sectarianism of caste

and religion.

The learner should be able to take firm steps and deferred against the social crisis like privatisation, liberalisation, globalisation etc. and against all kinds of dominations.

They should develop a discrimination to use the acquired learning as a liberative weapon.

They should be able to view education and life with the perspective of social well being.

They should get opportunity to recognise that co-operation is better than competition and that co-operation is the key to social life and culture.

A basic awareness of all the subjects needed for life essential for all students.

The remnants of perspectives formed in us during the colonial period still influence our educational philosophy. The solution to the present day perplexities of the society which approaches education on the basis of competitions and marketisation is only a comprehensive view of life.

It is high time that education was recognised on the basis of the philosophy of human education. The human approach to education has to reflect in its content, learning process and outlook. The perspective of 'learning to be ' and learning to live together as expressed by the UNESCO and the concepts of existentialist intelligence intrapersonal and interpersonal intelligence.

The basis of new approaches on curriculum, teaching- learning process are derived from the developments place in the east and west of the world.

When we begin to see the learner at the centre of the learning process, the teaching process has to be changed timely. It is the result of the rapid growth and development of Science and Technology and Pedagogy. If we want to undergo the changing process, we have to imbibe the modern hypothesis regarding learner, they have;

- Great curiosity
- Good imagination
- Numerous other qualities and interests
- Independent individuality
- Interest in free thinking and working in a fearless atmosphere.
- Have interest in enquiring and questioning.
- Ability to reach conclusions after logical thinking.
- ability for manifest and establish freely the conclusions arrived at.
- Interest for recognition in the society.
- Determination to face the interference of society and make components which is a part of social life.

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When we consider the learning system, the domains to be stressed in education according to the modern development becomes relevant.

The ***knowledge*** domain consists of

- Facts
- Ideas
- Laws
- The temporary conclusions and principles used presently by scientists.

The learning is a process. The continuous procedures we undergo to reach a particular goal is process. The skills which are parts of the process to analyse the collected ideas and proofs and come to a conclusion is called *process skills.* Some important ***process skills*** are,

the skills;

- To observe
- To collect data and record
- To classify
- To measure and prepare charts
- To experiment
- To predict
- To recognise and control the variables
- To raise questions
- To generalis
- To form a hypothesis and check.
- To conclude
- To communicate
- To predict and infer
- To use tools.
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Observation *is the process of acquiring knowledge through the senses. It is purely objective oriented. Learning experiences which provide the opportunity to use all the senses may be used.*

The process of grouping is known as ***classifying****. Starting from simple groupings of data, it can extend to the level of classification into minute sub-groups.*

In addition to this, consider the skills related to ***creative domain*** also, they are skills:

- To visualize

- To connect facts and ideas in new ways
- To findout new and uncommon uses of objects
- To fantasize
- To dream
- To develop creative isolated thoughts
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Creativity is an essential component of process and activities. The element of creativity is involved in finding out problems, formation of hypothesis, finding 'solutions' to problems etc. Through activity oriented learning experiences, opportunities to express creativity can be created.

Again, the following factors consisting in the ***Attitudinal domain*** are also important as;

- Self confidence
- Love for scientific knowledge
- Attitude to know and value history
- Respect human emotions
- Decide with reasonable present problems
- Take logical decisions regarding personal values

'Hypothesis' is a temporary conclusion drawn using insight. Based on knowledge and experiences relating to the problems the causes and solutions can be guessed.

As regards the ***application domain*** the important factors are the ability to:

- observe in daily life examples of ideas acquired.
- take the help of scientific process to solve the problems of daily life.
- choose a scientific life style
- connect the ideas acquired with other subjects.
- integrate the subjects with other subjects.

Some basic stands have to be taken on the new scientific knowledge about intelligence learning and teaching. When such basic concepts are accepted changes are required in the following factors.

- The vision, approach, structure and content of the curriculum.
- The vision, approach, structure and content of the textbooks.
- Role of the teacher and the learner.
- Learner atmosphere, learning materials and learning techniques.

Some scientific perspectives accepted by modern world in educational psychology are given below.

Constructivism

This approach puts forward the concept that the learner constructs knowledge. New knowledge is constructed when ideas are examined and practiced in new situations relating them with the previously acquired knowledge and experience. That is assimilated into the congnitive structure of one's knowledge. This method which gives priority to critical thinking and proble solving provides opportunity for self motivated learning.

Social Constructivism

Social constructivism is a sub section of constructivism. Knowledge is formed, spread and imbibed and it becomes relevant in a social enviornment. Interactive learning , group learning, co-operative participatory learning, all these are concepts put forward by social constructivism.

The main propounders of constructivism are piaget, vygotsky and Bruner.

Discovery learning and interactive learning have prime importance. Learning takes place as a part of the attempt for problem solving. The activities of a learner who confronts cognitive disequilibrium in a learning situation when he tries to overcome it is leads to the renewal of cognitive structure. It is through this process construction of new knowledge and the assimilation of them that learning take place. Observation and enquiry are unavoidable factors. The learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing conceptions.

Learning is a live mental process. Rather than the ability for memorisation of facts cognitive process has to be given emphasis. The process of problem analysis, elucidation, critical thinking, rational thinking, finding out co-relation, prediction, hypothesis formation, application, probing for other possibilities, extracting the crux and other processes are of critical importance in learning.

Constructivism gives greater predominance to co-operative learning. Social and cultural factors influence learning. Sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity and collaborative learning, by sharing responsibilities with the objective of public activity, provide opportunity for effective learning.

In learning internal motivation is more important than external motivation. The learner should have interest and initiative in learning. Learning situation should be capable of forming a sense of ownership in of the learner regarding the learning process.

Learning is not a linear process. It progresses in a spiralled way advancing deeper and wider.

Learner-his nature and features

The learners in standard XI has undergone a learner centered and process oriented learning experience up to X standard. He is adequately competent to select vocational subjects according to his aptitude and interest and to acquire higher education and profession as he wishes. The aspirations about future life is framed in this particular age foreseeing national and international job oppurtunities. Some of the peculiarities of the learner at this stage are:

- Physical, intellectual an emotional planes are intensive changes during this age and their reflections can be observed.
- Ability to enquire, discover and establish cause-effect relationship between phenomena.
- Readiness to undertake challenges.
- Capacity to shoulder leadership roles.
- Attempt to interprest oneself.
- Susceptibility to different pressures.
- Doubts, anxieties and eagerness about sex.
- Longing for social recognition.

Needs of the learner

- To make acquaintance with a job through vocational education.
- To acquire more knowledge in the concerned area through higher education.
- To recognise and encourage the peculiar personality of the later adolescent period.
- To enable him to defend against the unfavourable circumstances without any help

Role of the Learner

- Active participant in the learning process.
- Acts as a researcher
- Sharer of information
- Sharer of responsibilities
- Collects information
- Takes leadership
- Involves in group work
- Acts as a co- participant
- Observes his environment
- Experiments and realises
- Makes interpretations and draws inferences.
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Role of the Teacher

The teacher should;

- consider the 'Stress and strain' of the teenagers
- understand the socio- economic and cultural background of the students.
- promote and motivate the students to construct knowledge.
- arrange proper situations to interact in and outside of the classroom.
- guide the students by explanations, demonstrations etc.
- promote opportunity for co-operative learning and collaborative learning.
- facilitate interpersonal and intra-personal interactions.
- act as a democratic leader.
- act as a problem solver
- effectively guide the students for the selection and conduct of various continuous evaluation elements.
- continuously evaluate the progress of the learners.
- gives scaffolding / support wherever necessary.
- motivate for learning
- promote divergent thinking.
- act as a democratic group leader.
- act as a co-learner
- gives variety of learning experiences.
- be a constant student
- facilitate for reference / data collection
- have a clear under standing about the age, needs, peculiarities, abilities, nature, aptitude etc. of the learner.
- have the ability to motivate the learner in order to acquire and enrich their knowledge.
- be a guide to the learner in developing insights and creating responses on current affairs.
- be capable to lead the learner into a variety of learning methods and process based on curricular objectives.
- be a link between school and community.
- be a good organiser, guide, friend, philosopher and co-learner.
- have an inter disciplinary approach in learning activities.
- be able to guide the learner in his / her career prospects based on his interest aptitude and ability.
- be impartial and democratic.
- provide ample experiences to attain the basic values and objectives of the curriculum.
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New Concepts of Learning

1. Discovery Learning-

The teacher has to create a motivating atmosphere for the learner to discover concepts and facts, instead of listening always. Creating occasion to progress towards discovery is preferred. Instead of telling everything before and compelling to initiate the models, situations are to be created to help the children act models as themselves.

2. Learning by discussion

That discussion leads to learning is Burner's theory. Here discussion is not opposing each other. It is a sharing on the plane of ideas. New ideas are arrived at by seeking explanations, by mutual giving and taking of ideas and by problem solving.

3. Problem solving and learning

Only when the learner feels that some thing is a problem to be solved that he takes the responsibility of learning it. It is an inborn tendency to act to solve a problem that causes cognitive disequilibrium in a particular area. It is also needed to have confidence that one is capable of doing it. The problems are to be presented in consideration of the ability and level of attainment of the learner.

4. Collaborative learning

This is the learning in which the responsibilities are distributed among the members of the group keeping common learning objectives. The common responsibility of the group will be successful only if each member discharges his duties. All the members will reach a stage of sharing the result of learning, equally through the activity with mutual understanding. The teachers who arrange collaborative learning will have to make clear the responsibilities to be discharged. This is possible through the discussion with the learners. Collaborative learning will help to avoid the situations of one person working for the whole group.

5. Co-operative learning

This is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources the learners develop a plane of social system in learning also. As there are no high ups and low ones according to status among the learners they can ask the fellow students doubts and for helps without any hesitation or in hesitation Care should be taken not to lead this seeking of help to mechanical copying. It should be on the basis of actual needs. So even while encouraging this exchange of ideas among the members of the group cautions acceptance is to be observed as a convention. There should be an understanding that satisfactory responses should come from each member and that the achievement of the group will be assessed on the basis of the achievement of all the members

6 Zone of Proximal Development

Vygotsky observes that these is a stage of achievement where a learner can reach by himself and another higher zone where he can reach with the help of his teachers and peers and elders. Even though some can fulfil the learning activity by themselves there is the possibility of a higher excellence. If appropriate help is forth covering every learner can better himself.

7 Scaffolding

It is natural that the learner may not be able to complete his work if he does not get support at the proper time. The learner may require the help of the teacher in several learning activities. Here helping means to make the learner complete the activity taking responsibility by himself. The teacher has to keep in mind the objective of enabling the learner to take the responsibility and to make it successful.

8 Learning: a live mental process

Learning is a cognitive process, only a teacher who has an awareness as to what the cognitive process is alone can arrange learning situations to the learner to involve in it. Learning can be made effectively and intellectual sharpness can be improved by giving opportunity for the cognitive processes like reminding, recognising compromising , co- relating, comparing, guessing, summarising and so on. How is cognitive process considered in language learning? Take guessing and prediction for example.

- Guessing the meaning from the context.
- Guessing the content from the heading.
- Predicting the end of the story.
- Guessing the incident, story from the picture.
- Guessing the facts from indications.
- and other such activities can be given the following activities can be given for the cognitive process of summarisation.
- Preparation of blue print.
- Preparation of list.
- Preparation of flow chart.
- Epitomising in one word.
- Giving titles and so on.
- Symbols, performance of characters indications, lines of a poem, tables, pictures, concepts, actions, body language and such things can be given for interpretation. Process based language given for interpretation. Process based language learning has to give prime importance to the cognitive process.

9 Internal motivation

Internal motivation is given more importance than external motivation. The teacher

has to arouse the internal motivation of the learner, A person internally motivated like this alone can immerse in learning and own its responsibility. How motivating is each of the activities is to be assessed.

10 Multiple intelligence

The Theory of Multiple Intelligence put forward by Howard Gardener has created a turning point in the field of education. The National curriculum document has recommended that the curriculum is to be designed taking into consideration of this theory.

Main factors of the intellect :

1. Verbal/linguistic Intelligence -

Ability to read and write, making linguistic creations , ability to lecture competence effective a communication , all these come under this . This can be developed by engaging in language games and by teaching others.

2. Logical /mathematical Intelligence

Thinking rationally with causes and effect relation and finding out patterns and relations come under this area, finding out relations and explaining things sequential and arithmetical calculations are capable of developing this area of intelligence.

3. Visual /spatial Intelligence

In those who are able to visualise models and bringing what is in the imagination into visual form and in philosophers, designers and sculptors this area of intelligence is developed. The activities like modelling using clay and pulp, making of art equipments, sculpture, and giving illustrations to stories can help the development of this ability.

4 Bodily Kinaesthetic Intelligence

The activities using body language come under this. This area of intelligence is more developed in dancers and actors who are able to express ideas through body movements and in experts in sports, gymnastics etc.

5 Musical Intelligence

This is an area of intelligence which is highly developed in those who are able to recognise the different elements of music in musicians and in those who can here and enjoy songs. Playing musical instruments, initiating the songs of musicians, listening silently to the rhythms and activities like this are capable of developing this area of intelligence.

6 Interpersonal Intelligence

Those in whom this area of intelligence is developed show qualities of leadership and behave with others in a noble manner. They are capable of understanding the thought of others and carrying on activities like discussion successfully.

7 Intrapersonal Intelligence

This is the ability to understand oneself. These people can recognise their own abilities and disabilities. Writing diaries truthfully and in an analysing way and assessing the ideas and activities of others will help developing this areas of intelligence

8 Naturalistic Intelligence

A great interest in the flora and fauna of the nature, love towards fellow beings interest in spiritual and natural factors will be capable of developing this area.

9. Existential Intelligence

The ability to see and distinguish ours own existence as a part of the universe, ability to distinguish the meaning and meaninglessness of life, the ability to realise the ultimate nature of mental and physical existences, all these are the peculiarities of this faculty of intelligence.

Emotional Intelligence

The concept of emotional intelligence put forward by **Daniel Golman** was used in framing the new curriculum. The fact that one's **Emotional Quotient (E.Q)** is the greatest factor affecting success in life is now widely accepted. The teacher who aims to focus on improving the emotional intelligence of students need to concentrate on the following.

i) Ability to take decisions

Rather than imposing decision on students while planning and executing activities, the students may be allowed to take part in the decision making process. Taking decisions through open discussion in the class, inviting students suggestions on common problems etc. are habits to be cultivated.

ii) Ability to reach consensus

- When different opinions, ideas and positions arise the students may be given the responsibility to reach a consensus.
- Imaging what would be the course of action in some situations, allowing to intervene in a healthy way in problems between individuals.

iii) Problem solving

- Developing the idea that there is reason and solution to any problem.
- Training in finding reasons for problems.
- Suggesting solutions through individual or group efforts.
- Discussing social problems.
- Analysing the shortcomings in methods to solve problems.

Whether plastic can be banned within school premises can be given as a problem. Group discussion will provide reasons and solutions. Problems which can influence classroom learning and for which the learner can actively contribute

solutions need to be posed.

- Self criticism, evaluation
- Ability to face problem-situation in life
- Thinking what one would do if placed in the situation of others, how one would respond to certain experiences of others - All these foster the growth of emotional intelligence.

iv) Life skills

Life skills need to be given a prominent place in education. W.H.O. has listed ten skills required for success in life.

- Self awareness
- Empathy
- Inter personal relations
- Communication
- Critical thinking
- Creative thinking
- Decision making
- Problem solving
- Copying with emotion
- Copying with stress

The new curriculum addresses these areas.

Knowing the characteristics of the learner, role of the teacher and how to use the teachers handbook help the teacher to plan and effectively implement learning activities.

Objectives of the Vocational Higher Secondary Curriculum.

- To facilitate higher education while giving opportunity to enter in the field of employment.
- To develop enviornmental awareness, sense of national integration, tolerance and human values so as to ensure social and cultural improvement.
- To enable the learner to find on his own employment.
- To inculcate mental courage in the learner to face unfavourable situations.
- To make human resource development possible.
- To enable the learner to understand social problems and to react appropriately.
- To develop the learner to identify and develop his own competencies.
- To develop vocational aptitude, work culture and attitude in the learner so as to provide useful products and services to the society.
- To create an awareness about mental and physical health.
- To acquire awareness about different job areas and to provide backgrounds

for acquiring higher level training in subjects of interest.

- To develop possibilities of higher education by creating awareness about common entrance examinations.
- To provide situation for the encouragement of creative thinking and organising training programmes in each area, creative abilities and to develop artistic talents.

Nature of Approach

The learning device is to be organised in the selected vocational subjects in such a way that adequate practical experience should be given, making use of the modern technology. The development in each area on the basis of information technology is to be brought to the learner. The work experience in the respective fields (OJT, Field trip, Production / Service ..... training, Survey, Workshop, Exhibition, Youth festival, Physical fitness etc.) are to be adjusted suitable to the learning and evaluation process. The participation and leadership of the students in planning and execution is to be ensured through this kind of activities. Social service is to be made a part of the course.

Approach towards Vocational Higher Secondary Education

The learning methodology has to be organised so as the learning provide adequate practical thinking on the opted vocational subject utilising the new technology. The development of information technology should be made available in each sector. Work experience, OJT, Field trip production, Service cum training centre, Survey, Workshops, Exhibitions, Youth festivals, Physical fitness etc should be systematised well appropriate to learning and evaluation. Learner participation should be ensured in the planning and implementation of these activities. Social service should be a part of the course. If a learner has to change his school, he should be provided an opportunity to continue his studies in the new school. While considering criteria for admission to higher courses, grades of vocational subjects should also be given due weightage. In tune with the changes in the Vocational Higher Secondary Education changes should be ensured in the field of higher education.

The teachers have to take special care in arranging learning activities for the development of all the faculties of intelligence.

Learning activities and learning atmosphere.

A proper learning atmosphere is essential for the betterment of learning activities.

They are:

- Proper physical environment
- Healthy mental atmosphere
- Suitable social atmosphere

- Active participation of PTA, Local bodies and SRG
- Reference materials and visual media equipments.
- Academic monitoring
- School Resource Group (SRG)

3. PARAMEDICAL SUBJECT APPROACH

A. Paramedical Subject Approach

Modern developments in the field of medical science and information technology have caused a methodological upliftment in medical education. Vocational education in Kerala has been following the activity based learning to a certain extent. Is the new learner centered and process oriented pedagogy is widely accepted it echoes in the paramedical education of VHSE also. Thus the education system is undergoing a sea change from passive learning to active process oriented learning.

In this scenario the teacher's role is not just one of a knowledge provider but of an efficient facilitator who helps the learner to acquire knowledge. So the learner centred apporach provides oppurtunities to develop and utilise the innate qualities in the learner to construct new concepts through modern and advanced activities, especially in the field of modern medicine.

Introduction

The aim of paramedical courses of Vocational Higher Secondary Education is to make learners capable enough to achieve better health care on the basis of modern medical sciences. There are six paramedical courses under new curriculum:

- Medical Laboratory Technician Course
- Maintenance and Operation of Biomedical Equipment Course
- ECG and Audiometric Technician Course
- Domestic Nursing
- Dental Technology
- Physiotheraphy

Objectives

- To familiarise the latest technologies of modern medicine
- To make learners able to use use new and updated diagnostic methodologies
- To make learners capable enough of adopting the methods of recovery and improving health with a service approach

- To make learners capable enough to adopt the methods of recovery and improving health with a service approach.
- To make learners aware of the fact that the paramedical stream help the physician in accurate diagnoses and better treatment.
- To make aware learners the people of the important social issues connected with health.

Learning Approach

- The learning process has to be learner centered and activity oriented enabling learners to acquire skills and efficiency
- The learning process must enable learners to acquire more operational skills based on previous knowledge and experience
- It should assimilate the up to date technological developments in the field of modern medical science
- Learning approach shall enable the learner to develop multiple intelligence

Contents

Course details of each and every one of the six paramedical courses are prepared to meet the needs of their particular course. This also is in tune with the objectives of each course.

Learning Techniques

The learning techniques and means that could be used in paramedical courses are as below:

1. Project
2. Assignment
3. Seminar
4. Group dicussion
5. Practical experiments
6. Demonstration
7. Debate
8. Collection
9. Internet / IT
10. Quiz
11. Role play
12. Field visit
13. Reference- books, journals
14. Discussion
15. Models
16. Charts

17. Vocational survey
18. Exhibition
19. Production cum training
20. OJT
21. Viva
22. CD / Slide show
23. Slide show in OHP
24. Brain storming

Evaluation

- Continuous and comprehensive evaluation is envisaged.
- Evaluation methods are to be transparent, flexible, valid, reliable and practicable.
- Evaluation indicators are to be practicable.
- New curriculum should always be kept in mind for evaluation.
- Evaluation methods will have to motivate learners to develop multiple intelligence.

Planning

There is a year plan, term plan, and lesson plan.

Support Mechanism

Financial management, infrastructure development including acquisition of equipement and maintenance of all assets could be thorough the support mechanism consisting of

- School PTA
- Local and collaborative institutions
- Local bodies
- VHSE regional office
- VHSE directorate
- NGO's
- Government support
- Staff support
- Local community
- Public library etc

B. Subject Approach
Maintenance and Operation of Biomedical Equipment (MOBE)

Introduction

Maintenance and operation of biomedical equipment (MOBE) is one of the six paramedical courses under the science group of Vocational Higher Secondary education. The chief aim of this course is to make learners capable enough of operating and maintaining various biomedical equipment. Lack of sufficient man power in this field is a problem faced by the science of modern medicine.This course is therefore, introduced to mould persons capable of to operate and maintaining modern biomedical equipment.

Learning Objectives

The main objective of this course is to acquire technical expertise to operate and maintain biomedical equipment used for diagnosing, treating and health care activities of patients. Apart from acquiring technical expertise this course will enable the learner to persue higher education in this field.

Learners should be given oppurtunity for projects, assignments, seminars, discussions, debates, symposium, field visits, camps, clinics, practical experiments etc. They should be familiarised with OJT, PCT, exhibitions, vocational survey, capacity building etc. so as to enable them to aquire job expertise and basic qualification for pursiuing higher education in this field.

Learning Approach

The learning approach is learner centered. It will help the learners to develop and acquire skills and efficiency. It will help learners to acquire more operational skills through acquiring related technical knowledge, developing human and scientific attitudes, amalgamating theory and practice etc. The learning approach must create inquisitiveness in learners.

Learning Techniques

The learning process has to be learner centered and activity oriented enabling learners to acquire new skills and efficiency. The activities given to the learners should relate to the existing enviornment of learners so as to enable them to analysie and develop new concepts and ideas. Participation of learners must be ensured in all kinds of learning activities.

Activities

- Project
- Assignment
- Seminar
- Group discussion

- Practical experiment
- Debate, symposium
- Field visit.
- Exhibition, Vocational Survey
- Capacity building (OJT, PCT)

Support Mechanism

Financial management, infrastructure development including library, acquisition of equipment and maintenance of allassets could be thorough the support mechanism consisting of School PTA, collaborative institutions, local bodies, Panchayat, Government, Vocational Higher Secondary department, Regional Office of VHSE, etc.

Evaluation

Evaluation consists of Continuous Evaluation (CE) with a weightage of 20 Score and Term end evaluation (TE) with a weightage of 80 Score

Practical Evaluation (PE) - 150

Vocational Competency Evaluation (VE) - 50

Seminar

Stages:

- **Planning**
  - Selection of Topics
  - Dividing into subtopics
  - Assigning subtopics to the members of the group
  - Assigning of group activities
  - Fix presentation,venue, date and time
  - Selection of guide
  - Data collection and reference
  - Discussion with the guide
  - Presentation of the seminar paper
- **Execution (paper presentation)**
  - Venue arrangement
  - Paper presentation by each member of the group
  - Raising questions and discussions
  - Recording

- **Report presentation (summing up deliberation)**
  - All members of the group should collect all points from various subtopics presented by the group members and prepare a detailed seminar report. Then it should be submitted for evaluation by facilitator.
- **While presenting seminar paper all the learner are directed to note necessary details of their references about topics.**

Evaluation

Stages:

- Planning and organising
- Data collection
- Paper presentation / participation in discussion, raising questions and answering
- Preparation of seminar paper
- Seminar report

Project Work

Stage - I

Planning

- Feeling the problem
- Definition of objectives
- Formulating hypothesis
- Methods and tools
- Codification of information
- Analysis
- Making inference

Preparation of Project Report

- Heading (Title)
- Introdcution (Relevance and Background)
- Aims and objectives
- Methods and tools of study
- Result of the study- (Ordering of the findings)
- Analysis
- Inference
- Suggestions
- References (Source used)
- Thanks
- Appendix

Presentation of the Report

- Selection and arrangement of venue
- Workout materials (charts, tables, slides, graphs, pictures etc.)
- Use of modern equipment if possible (OHP, TV, LCD....)

Evaluation

- Planning
- Data collection
- Analysing capacity
- Report and Project Diary
- Presentation and involvement

Assignment

Various Angles

1. Preparatory Assignment

- For evaluating previous knowledge
- Enviornment creation for new curriculum objectives

2. Study Assignment

- Self learning process
- Involvement of the student for acquiring more data

3. Revision Assignment

- Practicing and recurrence
- Self assignment

4. Remedial Assignment

- Self improvement process
- Scaffolding to poor children

Various Stages of Assignment

Selection of Topics.

- Data collection and inference
- Individual or group work

Execution

- Data sharing
- Refinement of figures and facts
- Preparation of assignment
- Submission of assignment

Evaluation

- Understanding the topic.
- Content
- Structural and graphical / language representation
- Self observation, evaluation, suggestion
- Alloted time

Collections

Various stages

1. Planning

- Selection of Topics
- Data collection, reference
- Individual / group work

Execution

- Preparation of collections
- Submission of collections

Evaluation

- Collection linked with curricular objectives
- Goodness of Activities / Attractiveness
- Completion of content area
- Involvement
- Responsibility
- Alloted time

Records

Various stages

Planning

- Selection of Topics
- Data collection, reference
- Individual / group work

Execution

- Preparation of records
- Submission of records

Evaluation

- Collection linked with curriculum objectives
- Goodness of Activities / Attractivness

- Completion of content area
- Involvement
- Responsibility
- Alloted time

Debate

Various stages

- Selection of topics
- Selection of groups
- Selection of a moderator
- Collection of information
- Conducting the debate
- Conclusion

4. CURRICULUM OBJECTIVES

A. Course Objectives

1. To equip the students physically, mentally, intellectually and technically so as to enable them to handle maintenance and operational problems of Biomedical equipments, efficiently and effectively.
2. To acquire knowledge about Biomedical equipment operations and maintenance requirements so as to enable them to work as effective and efficient Biomedical technician, ECG technician, X- ray technician, EEG technician, EMG technician, Cath-lab Technician, audiology technician, manifold technician .... etc.
3. To build up trouble shooting and problem solving capabilities.
4. To assist Biomedical engineer in maintaining and servicing biomedical equipments.
5. To acquire skills in sales, service and marketing biomedical equipments.
6. To equip them to become successful enterpreneurs through self employment and wage employment.
7. To help them find employment as lab assistants in various deparments in medical institutions and other educational institutions like VHSS.
8. To make them realise the significance of Biomedical field.
9. To keep them in pace with the state of art facilities through field visit, OJT, seminars, exhibitions, workshops and camps.
10. To develop their presonal skills in observation, formulation of hyphothesis, methodology, analysis, inference, result presentation and report preparation and presentation.
11. To motivate them and steer then in career to find openings in related sectors.
12. To create interset in the subject by making clear in significance and relevance of the subject in modern medicine.
13. To create knowledge about the application of biomedical equipments in clinical practice and various walks of daily life.
14. To create awareness about the subject by imparting clear cut idea about the subject fundamentals and other aspecs related to it.

15. To acquire organising skills, leadership qualities, refined social behaviour personality development and communication skills through various group activities.

B. Curriculum Objectives

1. Basic idea of voltage and current (both AC and DC)
2. To create awarensss about electric charge, potential difference, electromotive force.
3. To familiarise and distinguish different types of materials based on electrical properties.
4. To find out the relationship between Current (I), Resistance (R), Voltage(V)
5. To understand the factors governing the resistance of a conductor.
6. To have basic idea of specific resistance, conductivity.
7. To acquire the knowledge of flow of current to and from a junction.
8. To acquire knowledge of relationship between voltage sources and voltage drops in a close loop.
9. To develop concrete idea of various fundemental concepts of AC.
10. To develop and idea of electromagnetic induction, self induction and mutual induction.
11. To understand transformer, its working and various types.
12. To familiarise and distinguish between ideal voltage source, real voltage source, real voltage source, direct and alternating voltage source, direct and alternating voltage sources.
13. To distinguish between active and passive electronic components.
14. To familiarise resisters, its colour coding and different types.
15. To familiarise different types of capacitors and inductors.
16. To group basic idea of series and prallel connection of resistance and capacitors.
17. To distinguish various substances depending on energy band with examples.
18. To acquire knowledge about PN junction biasing and VI characteristics.
19. To familarise zenordiode and its applications.
20. To acquire knowledge about transistor types, symbols and working.
21. To acquire knowledge about transistor connections and their applications.
22. To get basic idea of FET, SCR and their basic working.
23. To obtain and overview of IC's and microprocessors.
24. To understand classification of measuring instruments.
25. To understand multimeter, its working, application, mertis and demerits.
26. To obtain knowledge about CRO, its parts, working and applications.
27. To get an elementory knowledge about the connection of a signal generator to a CRO.

28. To develop a concrete idea of the various applications of electronic components.
29. To develop a concrete idea about rectifier circuits, filter circuits, transistor amplifiers.
30. To understand classification of amplifiers.
31. To get detailed knowledge about RC coupled and transformer coupled, direct coupled and transformer coupled, direct coupled, class A, class B, class C amplifiers.
32. To get and idea of damped and undamped oscillations.
33. To learn about tank circuit.
34. To learn about Hartley, Colpitts and Crystal oscillators.
35. To get an idea about cells, tissues, organs and different systems of the human body.
36. To get knowledge about bioelectric potential.
37. To understand electrical activity of a cell and cell potential wave form.
38. To create awareness about biological transducers.
39. To develop and idea of strainguage, LVDT, capacitance, manometer, temperature and light transducer.
40. To create an idea of basic medical reading system.
41. To basic knowledge about differential and chopper amplifiers.
42. To acquire knowledge about various properties and uses of radio isotopes and used in the medical field.
43. To acquire awareness of various departments in hospital enviornment.

5. SYLLABUS

A. Theory **140 hrs.**

Unit No.	Name of the Unit	No. of Hours
1.	Basic Electricity	20
2.	Basic Electronics	35
3.	Measuring Instruments	16
4.	Electronic Circuits	34
5.	Bio- Medical Instrumentation	35
	Total	**140 hrs**

Term wise distribution of Units (First Year Theory)

I Term : 1.1 to 2. 8

II Term : 2.9 to 4.8

III Term : Unit. 5

Unit.1: Basic Electricity **20 hrs.**

1.1 Concept of Direct Voltage and Current **2 hrs**

1.1.1 Definition of Voltage, Current, Electric charge, Potential difference, emf.

1.1.2 Definition of conductors, Semi conductors and insulators

1.2 Ohm's Law

1.2.1 State Ohm's law and explain

1.2.2 Simple problems based on Ohm's law

1.3 Laws of resistance **2 hrs.**

1.3.1 State and explain laws of resistance

1.3.2 Definition of specific resistance, resistivity and conductivity.

1.4 Kirchoff's Law

1.4.1 Kirchoff's current Law (Statement and Explanation)

1.4.2 Kirchoff's Voltage Law (Statement and Explantion)

1.5 Fundamentals of A.C 3 hrs.

1.5.1 Definition of peak value, RMS value and average value of A.C.

1.5.2 Definition of cycle, period and frequency of A.C.

1.6 Magnetism- Introduction 2 hrs

1.6.1 Definition of magnetic field, magnetic flux and flux density.

1.7 Electro Magnetic Induction

1.7.1 State and Explain Faraday's Laws of electromagnetic induction.

1.7.2 Define self and mutual induction.

1.8 Transformers 5 hrs

1.8.1 Principles construction and working of transformer

1.8.2 Transormer equation and simple problems.

1.8.3 Classification of transformers according to construction and working.

Unit.2: Basic Electronics 35 hrs.

2.1 Electronics- Introduction 1 hr.

2.1.1 Definition of Voltage source and ideal voltage source.

2.1.2 Define direct and alternative viltage source with examples.

Definition of peak value, RMS value and average value of A.C.

2.2 Electronic Components - Classification 1 hr.

2.2.1 Classification Electronic Components as active and passive.

2.3 Resistors

2.3.1 Definition, symbolsm types and colour coding of resistance.

2.3.2 Series, parallel and combination of capacitors and simple problems only.

2.4 Capacitors 5 hrs.

2.4.1 Definition, symbol and types of capacitors

2.4.2 Series, parellel and combination of resistor simple problems only

2.5 Inductors 1 hr.

2.5.1 Definition, symbol and types of Inductors

2.6 Semiconductors 3 hrs.

2.6.1 Definition and properties of semiconductors with examples

2.6.2 Classification of substances based on energy band.

2.7 Intrinsic and extrinsic semiconductors 2 hrs.

2.7.1 Definition and explanation of intrinsic and exrinsic semiconductors

2.7.2 Definition and explanation of P and N type semiconductors.

2.8 P- N junction **5 hrs.**

2.8.1 Definition, symbol and properties of PN junction

2.8.2 Forward and reverse biasing of a PN junction

2.8.3 Characteristics of PN junction

2.8.4 Definition of PIV, Knee voltage and break down voltage

2.9 Zener diode **2 hrs.**

2.9.1 Definition, symbol and uses of Zener diode

2.10 Transistors **5 hrs.**

2.10.1 Definition, symbol and types of various transistors

2.10.2 Working transistors

2.10.3 Transistors are an amplifier

2.10.4 Transistors of configuration- CB, CE, CC (only circuit details)

2.11 FET **1 hr.**

2.11.1 Definition, Symbol and working of P- channel and N- channel FET.

2.12 SCR **2 hrs.**

2.12.1 Definition, Symbol and working of SCR.

2.13 Integrated Circuits

2.13.1 Basic idea of Integrated Circuits and its applications

2.14 Micro processor **1 hr.**

2.14.1 Basic idea of integrated Circuits and its applications.

Unit.3 : Measuring Instruments 16 hrs.

3.1 Introduction **1 hrs.**

3.1.1 Introduction- Classification of measuring instruments definitions of accuracy, sensitivity, errors and range.

3.2 Multimeter **6 hrs.**

3.2.1 Multimeter as volt meter

3.2.2 Multimeter as Ammeter

3.2.3 Multimeter as Ohm meter.

3.2.4 Application, merits and demerits of Multimeter

3.3 CRO **8 hrs.**

3.3.1 Working and block-schematic of CRT

3.3.2 Block diagram and working of a CRO

3.3.3 Application of CRO

3.4 Signal generator- introduction only **1 hrs.**

3.4.1 Introduction to signal generator

Unit. 4 : Electronic Circuts 34 hours.

4.1 Rectifiers- half wave, full wave and bridge rectifiers **7 hrs.**

4.1.1 Define rectifier and explain its type.

4.1.2 Circuit details and operation of half wave rectifier

4.1.3 Circuit details and operation of full wave rectifier

4.1.4 Circuit details and operation of bridge rectifier

4.2 Filter Circuits 3 hrs.

4.2.1 Definition of filter circuits

4.2.2 Working of C, L, LC and Pl filters

4.3 Power supply regulator - Zenor Regulator 1 hr.

4.3.1 Zener diode as a voltage regulator

4.4 Transistors Amplifier 3 hrs.

4.4.1 Single and multistage and amplifiers advantages

4.4.2 Definition and explanation of gain frequency response and band width.

4.5 Classification of Amplifiers 3 hrs.

4.5.1 Classification of amplifiers according to use, frequency capabilities coupling methods and mode of operations.

4.6 Detailed study of R-C coupled, transformer coupled, direct coupled, class A, class B, class C amplifiers. 7 hrs.

4.6.1 Circuit and operation of RC couples amplifier

4.6.2 Circuit and operation of transformer coupled amplifier

4.6.3 Circuit and operation of direct coupled amplifier

4.6.4 Circuit and operation of class A, Class B and Class C amplifier

4.7 Feed back 2 hrs.

4.7.1 Definition and explanation of positive and negative feedback

4.8 Oscillators- Hartley Oscillator, Collpitt's Oscillator and Crystal Oscillator 8 hrs.

4.8.1 Definition of damped and undamped oscillation

4.8.2 Working of tank circuits

4.8.3 Circuits and operation of Hartley, collpitts and crystal oscillator

Unit. 5: Bio- Medical Intstumentation 35 hrs.

5.1 Introduction of Anatomy of human body 7 hrs.

5.1.1 Elementary knowledge about various terms used to describe human body cells and tissues.

Naming of various systems of the body

5.2 Bio- electrical potentials 4 hrs.

5.2.1 Electrical activity of a cell- resting, membrane-potential action, potential- typical cell potential wave form.

5.3 Biological transducers **7 hrs.**

5.3.1 Definition and classification of transducers.

5.3.2 Elementary knowledge of strain gauge LVD, Capacitance manometer, temprerature, potentiometer and light transducers.

5.4 Basic Medical recording system **8 hrs.**

5.4.1 Definition, explanation and block diagram of basic medical recording systems.

5.4.2 Biomedical amplifiers- basic knowledge of differential and chopper amplifiers.

5.5 Radio- isotopes and radiations, used in medical field **5 hrs.**

5.5.1 Properties and uses of radio isotopes

5.5.2 Properties and uses of different types of radiation used in medical field.

5.6 Introduction to various departments in a hospital enviornment **4 hrs.**

5.6.1 Elementary knowledge about hospital organisation.

B. Practical

Electromedical Workshop

Name of Experiment

1. Electronic symbols
   Resistors, Capacitors, Transformers, Diode, Transistor, SCR, FET.
2. Drawing electronic circuits
   a. Block diagram
   b. Schematic diagram
3. Identification of components and tools used in electronic workshop
   a. Different type of components: Resistors, capacitors Transformers, Diodes, Transistors, SCR, Thyristor, UJT
   b. Tools:- Screw drivers, cutting pliers, liner tester tweezers, soldering iron.
4. Colour coding resistors.
5. Soldering practice
   Introduction, mechanism of soldering, types of soldering iron, use and maintenance and de-soldering practice.
   (Soldering excerises should be done on a P.C.B lug strip)
6. Study and fabrication of series and parallel circuits.
7. Study of transformers used in electronic circuits.
8. Study if Multimeters- parts, uses of digital and analog Multimeter.

9. Study if CRO- Measure of amplitude and frequency.
10. Testing of electronic components using multimeter.
11. Study and fabrication of half wave rectifier.
12. Study and fabrication of full wave rectifier.
13. Study and fabrication of full wave bridge rectifier.
14. Study of zener voltage regulators (demonstration only)
15. Study of wave forms in CRO- Rectified and filtered output wave forms.
16. R.C coupled amplifier- Demonstration only.
17. Identification of signal generators.
18. Hospital organisation field visit.
    a. Field visit to various departments in medical collages, district hospitals, clinical laboratories and to anatomy museum, biophysics laboratory etc.
    b. Making notes and records on different types of equipments used in various departments (different models, manufactures and suppliers should specified with appropriate technical specifications.

6. PLANNING

The role of teacher as well as the learner has changed in the emerging scenario. So teacher being the facilitator should bear in mind the fact that the C.O's are to be accomplished within the specified time schedule. In order to fulfill this goal the facilitator should prepare necessary plan. Four such plans are given below which include field visit to a collaborative institutions, OJT, Surveys, Exhibition and all the teaching learning activities include and outside the class room.

- Year Plan
- Term Plan
- Unit Plan
- Daily Plan

Year plan covers all the unit and the entire activities to be completed with in a year.

Term plan covers all the activities scheduled to be completed in a term since term and evaluation is important.

Unit plan include all the portions, processes and activities before studying a unit. This plan must give reveal the actual information about the curriculum objectives, concepts, process skills, activities, material required and evaluation.

Daily plan is the daytoday plan to provide activities for a period (one hour). The structure of daily plan is given with each chapter.

YEAR PLAN

Month	Units		Hours Alloted	
			Theory	Practicals
June	1.1 - 1.4	• Concept of direct voltage and current. • Ohm's Law • Laws of resistance • Kirchoff's Law	7	14
July	1.5 - 2.2	• Fundamentals if A.C • Magnetism • Electro magnetic Induction • Transformers • Electronics • Electronic components	15	22
August	2.3 - 2.8	• Resistors • Capacitors • Inductors • Semi conductors • Intrinsic and Extrinsic semi conductors • P. N junction	21	42

Month	Units		Hours Alloted	
			Theory	Practicals
September	2.9 - 3.1	• Zener diode • Transistors • FET • SCR • ICs • Microprocessor • Rectifier	19	44
October	3.2 - 3.6	• Filter circuits • Power supply regulator- zener regulator • Transistor amplifier • Classification of amplifier • Detached study of various amplifiers.	17	32
November	3.7 - 4.2	• Feed back • Various Oscillators • Introduction to measuring Instruments • Multimeter.	17	48
December	4.3 - 4.8	• CRO • Signal Generator	18	16

Month	Units		Hours Alloted	
			Theory	Practicals
January	5.1 - 5.3	• Introduction to anatomy of human body. • Bio electric potentials. • Biological transducers.	18	16
February	5.4 - 5.6	• Basic medical recording system. • Radio Isotopes. • Introduction to various departments in a hospital.	17	18
		Total	**140**	**272**
		Other Practicals	**.....**	**148**
				420 hrs

Other Practicals

1.	Identification and Drawing of Tools	- 10 hrs
2.	Electrical wiring and Fabrication of Extention of Boards	- 16 hrs
3.	Drawing of symbols	- 8 hrs
4.	Drawing of components	- 8 hrs
5.	Drawing of circuits	- 10 hrs
6.	Soldering practice	- 14 hrs
7.	Seminar by students	- 20 hrs
8.	Project	- 16 hrs
9.	Exhibition	- 10 hrs
10.	Seminar by experts	- 6 hrs
11.	Survey	- 10 hrs
12.	Field visit (Hospitals, Electronic Industris and Higher Educational Institutions)	- 20
	Total	**148 hrs.**

TERM PLAN

Term	Units
I.	1.1 to 2.8
II.	2.9 to 4.8
III.	5.1 to 5.6

Unit - 2 UNIT PLAN

Basic Electronics

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
• To familiarise Electronic Components	Active and passive electrical materials.	Distinguishing capacity. Classification Observation	Observation Identification Discussion Assignment Chart	Passive Components Active components	PE OT Report evaluation.
• To acquire knowledge about semiconductor physics.	Properties. Examples. Types.	Comparison. Classification.	Diagrams. Discussion.	Library books. Reference books. Internet.	OT. Report Evaluation.
• To develop a concreate idea about P. N junction Diodes and various aspects related to it.	P.N junction. Formation. Wording. Types and symbols.	Identification. Classification. Observation.	Experi-ments. Demonstra-tion. Diagrams. Testing (Demo). Discussion. Assign-ment.	Library Books. Reference Books. Diodes. Multimeter.	P.E (spotting) CT OT Report / Assignments.

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
• To acquire knowledge about transistors	BJT, NPN, PNP. JFET. Construction and working. Symbols.	Comparison. Identification. Classification. Observation.	Diagrams Testing (Demo). Discussion. Seminar.	Library Books. Reference Books. Transistors. Multimeter	Spotting. CT. OT. Presentation. Report.
• To familiarise Silicon controlled Rectifiers	Symbols. Working principles.	Identification. Observation. Communication.	Diagrams. Discussion. Chart.	Library Books. Reference Books. SCR.	Spotting. CT. OT.
• To acquaint Fundamentals of Integrated Circuits and microprocessors.	Basic Idea. Types.	Different types of IC's. Identification of IC's and their different uses.	Collection of different types of IC's.	I C mannuals. Reference Books.	Spotting. OT.

DAILY PLAN

Unit. 2

Electronics- Introdcution

Curriculum Objectives

- To get and idea about voltage source.
- To enable students to name a few sources of electrical energy.
- To distinguish between ideal and practical voltage sources.
- To get basic concepts about direct and alternating voltage sources.
- To differentiate between direct and alternating voltage sources.

Activity. 1
Demonstration

- Show maximum available voltages to students such as cells, batteries, rechargable batteries, generators, eliminators etc.
- Allow the students to observe each and every demonstrated voltage source and to prepare notes.
- Show the polarities of D.C sources.

Consolidation

- Concept of voltage source
- Functions of voltage source
- Polarity identification of D.C sources

Activity. 2
Discussion

- What are the daily uses of voltage sources.
- What are the different types of voltage sources.
- What are the differences between AC and DC
- What are the latest advancements in voltage sources.

Consolidation

- Differences between AC and DC
- Graphical representation of AC and DC
- Concepts of ideal voltage sources
- Differences between ideal and practical voltage sources.

7. EVALUATION

As the curriculum is based on a particular vocation, evaluation becomes an inevitable procedure. Evaluation is done along with learning process throughout the course of study. Inorder to make an evaluation, the teacher should be able to understand the students, their scholastic and co-scholastic knowledge. Capacity building in the selected vocation is the most important part in vocational education and it should be evaluated accordingly. The technical skills, interest and devotion in the particular field, communication skills, analysis, organising and presentation skills etc. have to be evaluated. The personal and social qualities also have to be evaluated. Thus evaluation is an integral part of learning process which assesses the implementation of the curriculum.

Need and importance of Evaluation

Evaluation is to assess the scientific knowledge of students and to recognise to what extent they have achieved the specified capabilities. A written examination at the end of an year which is purely based on a textbook is not of much use. "Evaluation is a systematic process of collecting, analysing and interpreting evidence of students' progress and achievement both in cognitive and non-cognitive areas of learning for the puprose of taking a variety of discussions".

The teacher can properly assess the level of the learner and can identify his / her strength and weakness. This will help each student to evaluate themselves and to improve their level of learning by taking necessary assistance from the teacher(self evaluation)classmates can evaluate themselves through interaction (peer group evaluation)Evaluation even help the teacher to analyse and improve their performance. Evaluation helps to integrate the teacher, learner and even the parents. Thus student who are socially useful and can perform productive work are created. This will improve the quality of our young generation.

Theories of constructivism and multiple intelligence are the basis of modern learning. So evaluation strategies have also to be changed. Evaluation must be;

- Continuous and comprehensive
- Scholastic and co-scholastic
- Depending on grading system.

- Depending on a vocational or trade proficiency.

Continuous and Comprehensive Evaluation

Most of our traditional evaluation methods are related only to the area of scientific knowledge or the memory of students. To eliminate the limitations of this method we are forced to evaluate the multi-dimensional competencies of the learner with respect to the practicability and nature of the subject.

Indicators for Continuous Evaluation can be

1. Assignment
2. Seminar
3. Class test
4. Project etc.

* For continuous evaluation class test (CT) is made compulsory taking any two of the above said indicators. CT can be a written test, oral test (viva), Practical test.

1. Assignment

Assignment is an activity to achieve the curriculum objectives undertaken by the students, in continuation with activities carried out in the class. It is a self learning cum evaluation activity and it should ensure that the work is completed within a stipulated time according to the teacher's direction by utilising the maximum capabilities of the students and exploring maximum possibilites . If same topic is given to all the students, the involvement of the students in his / her work should assure using some tools like viva-voce. If different tasks are assigned, the level of task should be uniform and evaluation indicators should be specified in advance. The activity begins in the classroom with proper planning and preliminary discussion and carried out completely outside the class. The document containing the activities should be submitted in time for the compeletion of evaluation. The document may be shared if it is relevant and there is demand if a student delivers more than one seminar the best is taken for CE reporting . Every student should be given a chance as it reflects his / her CE score.

Contents of Assignment

1. Title, Objective
2. Introduction, Collection of data
3. Analysis of the content
4. Conclusion
5. Report (Documentation)

2. Seminar

Seminar is a very effective selflearning activity which helps to go deeper into the different aspects of a particular topic in the syllabus. The infomation collected from various sources with the guidance of the teacher is systematically organised

and presented in the class so that the information it is shared among the students. The students from the audience can raise doubts and questions regarding the content and even contribute to the subject.

The topic and subtopics are to be emereged during discussion in the classroom as a need to know more about the topic. If there is sufficient content for the subtopics each of them can be assigned to each student, but they should work in a collaborative manner. A seminar paper or notes is prepared and submitted to the teacher for verification and authentication when the seminar is presented the other students record the points in their notebooks and each student prepare his / her own seminar paper of the same topic. At the same time the student who presents the paper also modifies his / her paper and reflect the points emerged during the discussion. All the papers are compared and evaluated to ensure the uniqueness of the efforts made by each student to acquire the information regarding the topic.

Contents of Seminar

Slection of topic

Collection of relevant information

Presentation of draft paper

Programe scheduling

Seminar paper presentation

Discussion- interaction

Finalisation of the document

Document submission

3. Class Test

A class test is done to evaluate the performance of students in the theory / practical classes. Those who are absent in a test may be given a chance on his / her request, if it is found genuine.

1. Class test may be oral test(viva) or written test, quiz, debate, practical test or any kind of testing the performance of the learner.
2. Class test is a tool to collect feed back from learners during learning process.
3. Class test can be conducted after the completion of a lesson or a unit.
4. It is a tool to find out and to slove the learning problems faced by the student.
5. Questions must be prepared by the teacher by following the guidelines from the authorities.
6. Self evaluation by the students or peer evaluation may be used apart from the evaluation by the teacher.

4. Project

A project can be used in testing the ability for designing and development. As in the case of any project, designing is a procesoriented activity, in which there are different stages to be evaluated and a product is evolved. It is group activity through which a work is developed using a package or any development tool.

The project begins with identifying the application area and the associated problems. The elements involved in designing are recognised and procedure or steps are derived. The students explore possibilities of co-operative and collaborative learning and apply their problem solving skill using development tool / package.

The students must be in touch with the teachers throughout the stages of project work. A project diary must be maintained. The teacher varify and guide to prepare the report. The project report should be evaluated and can be kept in the library for reference.

Project in first year MOBE from electronics or biomedical instrumentation.

Contents of a project

Title, preface

Introduction, topic, Objectives

Hypothesis, Collection

Analysis, Procedure

Conclusion

Preparation of report

Reference, Suggestion, Appendix

Presentation of Project

Structure of Project Report

1. Cover Page (Project title, Name of Students, Course and Duration)
2. Certificate
3. Preface / Abstract
4. Content

    Introduction

    Aims (Objectives)

    Problem study / Analysis

    Development Tools and Facilities used

    Source Code / Procedure / Steps

    Outputs

Conclusion

5. Annexure (Sample data, data sheet etc.)

3. Bibiliography

Project

Project in fisrt year MOBE can be from electronics. Project can be given to a group of students consisting of 5-10 members each.

A Suggested Project

1. Eliminator (0-12v- Variable)

Material required

Transformer - Multiple tap (0,1.5,3, 4.5, 6, 7.5, 9, 12)

Diode - IN 4007 (IA) - 4 numbers

Resistor - 1K $^{1}/_{2}$ W - 1 number

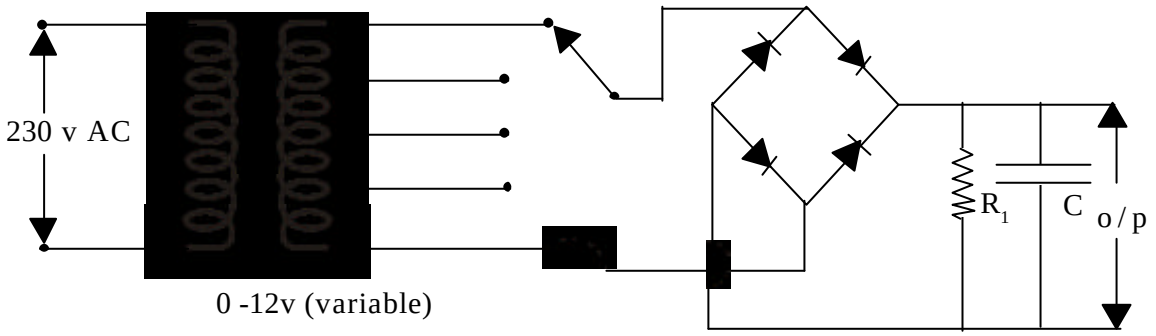
Capacitor - 1000 µ *f*, 25 v- 1 No.

PCB - General

LED - Red- 1 No.

Roatating Switch

Connecting cables, wires.



CE Item	Evaluation Indicators	Weightage	Score
1. Assignment	1. Awareness of the content	4/3/2/1	
	2. Comprehensiveness of the content	4/3/2/1	
	3. Systematic and sequential arrangement	4/3/2/1	
	4. Observation/suggestions/Views Judgements/ Evaluation	4/3/2/1	
	5. Timely Submission	4/3/2/1	20
2. Seminar	1. Ability to plan and organise	4/3/2/1	
	2. Skills in the collection of data	4/3/2/1	
	3. Awareness of the content (presentation of the paper, participation in discussion, ability to substantiate the ideas and views)	4/3/2/1	
	4. Ability to prepare the report (sequence in the presentaionof the concepts, authenticity and clarity of ideas/views/concepts	4/3/2/1	
	5. Quality of Seminar Document	4/3/2/1	20
3. Project	1. Ability to plan (Selection of the method for solution of the problem, identifying suitable tools, planning the various activities to be carried out in each stage)	4/3/2/1	
	2. Ability to collect data (sufficiency and Relevance of data. Classification and arrangement of data for analysis, reliability and authenticity of the Collected data.)	4/3/2/1	
	3. Ability to analyse the elements and procedure (Structuring of elements and developing logic. Efficieny in using the package/tool. Recognising design errors and correcting them)	4/3/2/1	
	4. Ability to prepare the project report (Reflection of the process skills. Communicability and authenticity of the report in relation with the Project diary	4/3/2/1	
	5. Viva Voce(Knowledge of the content and Process)	4/3/2/1	20

CE item calculation

Subject		item: Assignment					
Sl. No	**Name**	**Evaluation Indicators**					**Total Score (20)**
		I (4)	**II (4)**	**III (4)**	**IV (4)**	**V (4)**	
1	Anand	2	3	4	4	4	17
2	Shibu	4	3	4	4	4	19

Total CE calculation

Sl. No	**Name**	**CE Items**			**Total (60)**	**Total CE Out of 20**
		1 Class Test (20)	**2 Assigment (20)**	**3 Seminar/ Project (20)**		
1	Anand	18	17	19	54	18
2	Shibu	20	19	18	57	19

Terminal Evaluation (TE)

Terminal Evaluation is in written form. The test should not be aimed to test the memory alone. The terminal evaluation questions give more emphasis on application level, analysis and synthesis. The questions are framed so that the students are able to apply their different mental process. The maximum score is 80 and the minimum score of TE is 24 (30%).

Questions of TE can be-

Application level questions

Synthesis level questions

Comparison of facts

Challenging questions

Scope for obtaining innovative ideas

Giving creative thinking by the students

Questions based on the objectives of learning activities

Practial oriented questions

Enviornment related questions

Divergent thinking level questions

Subject Consolidation

Sl. No	Name	CE (20)	TE (80)	Total CE+ TE (100)	Grade

Grading

It is not scientific to assess the achievement of a student soley based in the marks in the terminal examinations. Marking system proved unscientific in evaluating the growth and development of students both in cognitive and non-cognitive areas. To overcome this shortcomings, a popular mode of evaluation based on students' performance- grading system- has been evolved. At the Higher Secondary stage, it is desirable to use a point absolute grading to co-ordinate and record the evaluation. After giving the score, they are changed into percentages and appropriate letter grades are awarded curresponding to each percentage. The score percentage and corresponding letter grade is given below.

Score in percentage	Grade
90-100	A+
80-89	A
70 -79	B+
60-69	B
50-59	C+
40-49	C
30-39	D+
20-29	D
Below 20	E

PE

PE is the important part of vocational practicals. The practical skills must be evaluated after completing all practical experiments in each term and at the end of the academic year. PE must cover all required indicators to evaluate the technical skill and practical knowledge of the different topics covered.

Indicators for PE are given below;

Indicators	Score	Total
Identification of tools / items	20	20
Procedures (2experts) (Written)	5 x 2	10
Technique / fabrication	20 x 2	40
Observation, Tabulation Inference	20 x 2	40
Result	5 x 2	10
Record	1 x 10	10
Viva		20
	Total	**150**

Vocational Competency Evaluation (VCE)

Being a vocational course, a system to judiciously evaluate the required value addition and consequent capacity building in the selected vocational subject is highly essential. As the other evaluation components like CE, PE and TE cannot assess the vocational competencies and professional skills acquired by the students, an internship evaluation (IE) component has been introduced to meet this requirement.

Internship evaluation should be done based on the following components.

I. Regularity and punctuality.

A regular presence and habit of time bound completion of task is a must for attaining maximum efficiency.

II. Value addition

Value addition can be evaluated through conducting field visits / survey. The experiences gained through field visit and survey increases the level of intrinsic motivation and positive attitude towards the vocational field and there by increase his value as a skilled semi- professional.

III. Capacity building

Capacity building can be evaluated through conducting the following activities.

1. OJT / Simulated experiment
2. Performance- Camp / Exhibition / Clinic.
3. Performance- Production / Service cum Training centre.

These components helps the students to practice the acquired skills in the real situation and there by increasing self confidence and promoting self reliance.

I. Regularity and Punctuality can be evaluated by 5 point grading system.

Rating scale

		1	2	3	4	5
1	Regularity	Never regular	Often regular	Usually regular	Most of the time regular	Always regular
2	Punctuality	Never Punctual	Often Punctual	Usually Punctual	Most of the time Punctual	Always Punctual

Regularity and punctuality can be assessed by using attendence of the student and time bound completion of tasks.

The aim of value addition is to measure the interest, devotion Group managment, persevernce of the learner in specific areas Value addition can be evaluated from field visit, survey and simulated experiments.

Capacity building is aimed at measuring the skills of the learner from OJT/ production cum training centre/ research and development/graded area exposure.

The minimum score of VE should be 30. The VE score in the first year should be carried over to second year as vocational education is a continuous process.

VCE Item	Evaluation Indicators	Weightage	Score
1. Regularity and Punctuality			10
2. Value addition	**Field Visit** 1. Attitude and readiness towards the task. 2. Capacity for observation. 3. Data collection. 4. Application of ideas. 5. Documentation / recording. OR **Survey** 1. Planning. 2. Data collection. 3. Consolidation of data and analysis. 4. Drawing inference. 5. Reporting.	 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1	20
3. Capacity building	**OJT/ Simulated Experiment** 1. Involvement / Participation. 2. Skills in doing work / Communication skill. 3. Time bound action. 4. Capacity for observation, analysis and innovation. 5. Documentation, Recording and display. OR **Performance in camp/ Exhibition/ clinic** 1. Ability for planning and organising. 2. Mastery of subject. 3. Ability for communication.	 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1	20

VCE Item	Evaluation Indicators	Weightage	Score
	4. Innovation.	4/3/2/1	
	5. Involvement / Social commitment.	4/3/2/1	
	OR		
	Performace in production/ service cum training centre (PSCTC)		
	1. Mastery of vocational skills.	4/3/2/1	
	2. Managerial capacity.	4/3/2/1	
	3. Promoting self confidence.	4/3/2/1	
	4. Innovative approach.	4/3/2/1	
	5. Promoting self - reliance.	4/3/2/1	

Vocational Competency Evaluation(VCE) Items **(Internship Evaluation)**

Items	Score
Regularity & Punctuality	10
Field visit / survey(any one)	20
OJT / simulated experiment Performance- Camp / exhibition / Clinic Performance- PSCTC (any one)	20
Total	50

A minimum of 80% attendence is required for promotion to the second year. Those who have shortage of attendence should repeat first year. Those who have 80% and above attendence but failed to achieve 30% of internship evaluation (IE) will be promoted to the second year. He has to improve the component in which he performed poor. He has to attain the minimum by improving the particular component to get eligible for appearing second year public examination.

Format for Subject Wise Evaluation

Sl no:	Name	CCE					TE (80)	Total (100)	Grade	PE								Vocational Competency Evaluation				
		1 (20) Class Test	2 (20) Assign-ment	3 (20) Semi-nar / Project	Total (60)	Total out of 20				1	2	3	4	5	6	Total	Grade	Regularity and Punctuality (10)	Value Addition (20)	Capacity building (20)	Total (50)	Grade

Format for School wise Score Sheet

Sl no:	Name	English				General Foundation Course				Vocational Subjects								Physics					Chemistry					Mathematics			
										CE	TE			PE		VCE															
		CE	TE	Total	Grade	CE	TE	Total	Grade	CE	TE	Total	Grade	Total	Grade	Total	Grade	CE	TE	PE	Total	Grade	CE	TE	PE	Total	Grade	CE	TE	Total	Grade

8. UNITWISE ANALYSIS

Introduction

Unitwise analysis is a guideline for better implementation of the curriculum. During the first year, teachers should guide the learners by explanations, demonstrations, experiments, discussions, seminars, project etc. so that the learners can acquire some idea of various concepts of basic electricity, basic electronics, electronic circuits, measuring instruments and biomedical instrumentation. The fundamental principles of electricity and electronics will be transacted during the first year because almost all the biomedical equipments are either electrical or electronic equipments. Detailed study of various electronic components, then types, application, familiarisation of electronic circuits, electronic devices and handling of measuring instruments is included.

The curriculum also includes basic idea of human anatomy, bioelectric potentials, biological amplifiers, biological transducers, radio isotopes and hospital organisation. The curriculum offers 140 hours for theory and 420 hours for vocational exposure through lab work, field visit, seminar, collection, projects, assignments, on the job training, capacity building etc. A detailed unitwise analysis is given here.

BASIC ELECTRICITY

Introduction

Electricity has now become an unavoidable factor in modern life. It is a branch of engeneering science which deals with the study of movement of charged particles. In this Unit we deal with various concepts and phenomena related to electricity. Here is a detailed study of voltage, current, Ohm's law, Kirchoff's law, laws of resistance, magnetism, Electromagnetic induction and transformer are given.

All these basic concepts of electricity equip the students to learn and practise the uses of electricity in biomedical field.

Curriculum Objectives

Basic Electricity

- Brush up basic idea of voltage and current (both AC and DC)
- To develop the idea about electric charge, potential difference, Electro motive force.
- To familiarise different types of materials based on electrical properties.

Ohm's Law

- To find out the relationship among current (I), Resistance (R), and Voltage (V)

Laws of Resistance

- To understand the factor governing the resistance of a conductor
- To have a basic idea of specific resistance, conductivity

Kirchoff's Laws

- To acquire knowledge about flow of current to and from a junction.
- To acquire knowledge about relationship between voltage sources and voltage drops in a closed loop.

Fundamentals of AC

- To develop a concrete idea of various fundamental concepts of A.C.
- To create awareness about the relationship between effective value and maximum value.

Magnetism

- To brush up the previous knowledge about magnet and magnetism.
- To develop an idea about the various terms related to magnetism.

Electro Magnetic Induction

- To develop a concrete idea of electromagnetic induction and its application.
- To understand self induction and mutual induction.

Transformers

- To familiarise transformers
- To know about the working of transformers.
- To distiguish between various types of transformers.

Syllabus

- Concepts of electric charge, electric current, voltage (potential difference), E. M. F, conductors, semiconductos and insulators.
- Ohm's law- statements and equations.

  V I graph - Simple problems

  Laws of resistance- $R = \frac{rl}{A}$
- Concepts of resistivity and conductivity, units.
- Kirchoff's laws - Statements of K C L and K V L
- Fundamentals of AC- Amplitude(peak value) cycle- Time period- Frequency- R. M. S value- Average value.
- Magnetism- properties of magnetic poles magnetic lines of force- magnetic field- magnetic flux- flux density- units.
- Electro magnetic induction- statements of Faraday's first and second law- self indution- mutual induction.
- Transformers- Principle structure of transformer symbol- Turns ratio- step-up and step-down- Auto transformer.

Time schedule	:	
Theory	:	20 hrs
Practical	:	40 hrs.

1.1 Concept of Direct Voltage and Current

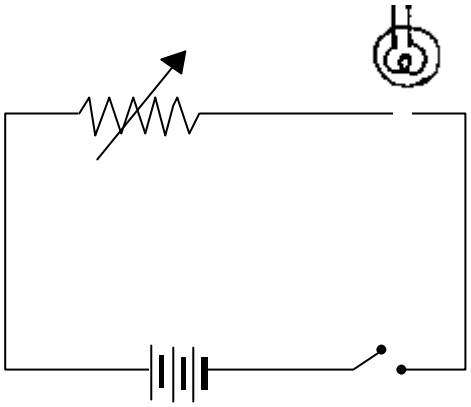
Activity.1
Recollection of previous knowledge

In order to develop an idea of electric charge, potential difference etc. Through group discussion, the teacher can help the students to recollect their previous knowledge of the topic.

1.1.1

Activity. 2
Demonstration

To help them to understand these concepts better the teacher can illustrate by constructing a simple circuit.



Observation

- Allow the students to observe and note the changes.

Activity. 3
Group disucussion:- Above demonstration

- Ask them to discuss among themselve about its observations
- Ask each group about its inference.
- Elicit response from the students.
- Encourage them to ask questions.
- The concept of charge, current, potential difference and electromotive force can be given as answers to their questions.
- Encourage the students to refer more to the topics to find more interesting facts about the concepts.

Consolidation

- Consolidation of charge, existence of positve and negative charge, charge refered to electrons.
- Unit of charge is coulomb, denotation. 'C'.
- Concept of current flow of electrons, rate of flow of charge, Analogous flow of water.
- Concept of potential difference- Difference in potential between the ends of a conductor in a circuit.
- Concept of electromotive force- It is the force which maintains the flow of charges between the ends of a conductor.

1.1.2 Conductors, Semiconductors, Insulators

Activity.1
Group Discussion

To familiarise different types of materials and distinguish each material based on their behaviour when voltage is applied to it. The materials according to their electrical properties must be specified.

Discussion points

- Different types of materials
- What will happen when voltage is applied to the above materials.

Observation

- The students are directed and encouraged to collect different types of materials.
- The learners will have to be guided to classify them into three groups.
- They are materials which conduct electricity, materials which partially conduct electricity and materials which do not conduct electricity.
- Materials which conduct electricity are called conductors and material which do not conduct electricity are called insulators, material which partially conduct electricity are called semiconductors.

Consolidation

- Conductors are substances which conduct electricity.
  eg: platinum, gold.
- Insulators are substances which do not conduct electricity
  eg: wood, plastic, mica
- Semiconductors are substances which partially conduct electricity.
  eg: germanium, silicon.

Activity.2
Chart making

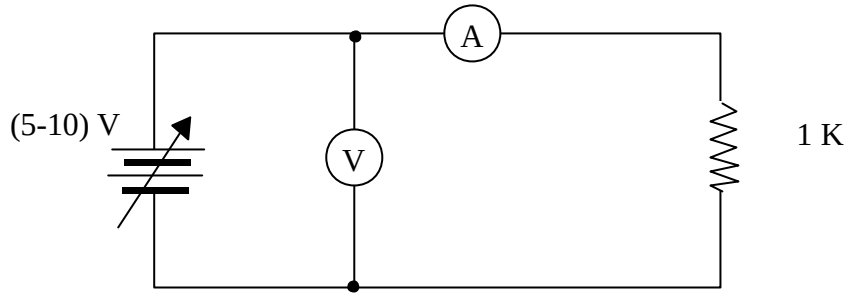
Chart making on different types of materials based on electrical properties.

1.2 Ohm's Law

1.2.1

Activity. 1
Demonstration

To familiarise the relationship between voltage, current and resistance. Drawing of a circuit diagram.



Materials Required

- A variable DC power supply
- Voltmeter, Ammeter and a load resistor
- The above components are connected as in the circuit diagram. The input voltage is varied and each time voltage and current are measured.

Discussion

- In the above circuit, as the voltage is increased the current is also increased. Why does it happen?
- Students are encouraged to discuss this matter.
- The teacher may correct or add relevant ideas connected with voltage and current relationship.

Observation

- The meter readings are observed for different values of input voltage. A table is drawn by using these parameters.

Inference

- It is observed that the voltage applied is directly proportional to the current flowing through the circuit.

Consolidation

Ohm's law

- Ohm's law states that at constant temperature the current flowing through a conductor is directly proportional to the potential difference between the ends of the conductor.

$$I \alpha V \text{ or } V \alpha I$$

$$V = IR$$

Where R is a constant known as the resistance of the conductor.

1.2.2

- Numerical problems based on Ohm's law can be given in this topic.

1.3 Laws of Resistance

1.3.1

Activity.1
Demonstration

1. Measure the resistance of wires having different lenght by using multimeter.
2. Measure the resistance of wires having different area of cross section.

Materials required

- Resistance wire, Multimeter

Discussion

- What is the change in resistance when the lengths of the conductor is changed.
- What is the change in resistance when the area of cross section is changed.
- What is the change in resistance if both the length and area of cross section of the conductor are changed.

Observation

1. The resistance of wires with different lengths are noted.
2. The resistance of wires with different area of cross sections are noted.

Inference

1. It is observed that resistance of a conductor is directly proportional to the length.
2. It is also observed that the resistance of a conductor is inversly proportional to its area of cross section.

Consolidation

The resistance of a conductor depends on the following points.

1. Resistance is directly proportional to its length (l)

$$R \alpha l$$

2. Resistance is inversly proportional to the area of cross section (a) of the conductor.

$$R \alpha l / a$$

3. Nature of the material:- Resistance will be different for different materials.
4. Temperature of conductor:- Resistance increases with rise in temperature.

1.2.3

Specific Resistance or Resistivity (?)

Specific resistance of a material can also be defined as the resistance between the opposite faces of a unit cube of that material.

Resistivity is the resistance of a conductor of unit length and of unit area of cross section. It is represented by the Greek letter α (rho)? .

1.4 Kirchoff's Law

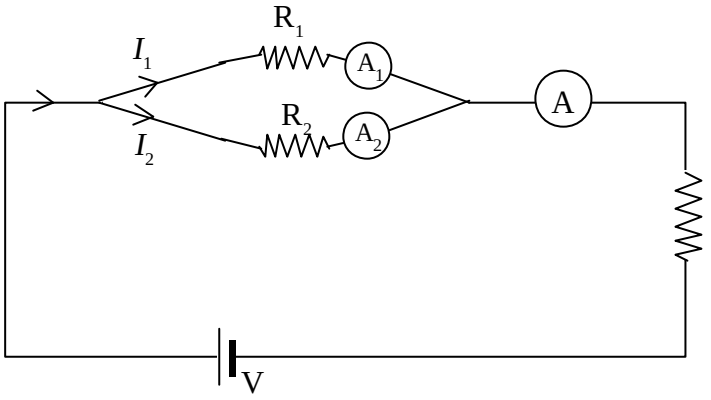
Activity.1
Group Discussion

To acquire knowledge about flow of current to and from a junction.

Let the students observe a single circuit having a voltage source and two resistors connected in parallel as given below. Now the students are directed and encouraged to discuss the flow of current from the voltage source and current distribution through the resistors.

- The total current I in the circuit.
- The current (I_1) through the resistor R_1
- The current (I_2) throguh the Register R_2
- Relation between I, I_1, I_2 can be ...

1.4.1 Kirchoff's Law



Verify by measuring the values from the above given chart.

Demonstration

- Connect the ciruit as shown in the above figure
- Measure the total current I
- Measure the branching currents I_1 & I_2

Observation

It is observed that total Current $I = I_1 + I_2$

Consolidation

- By using the above given circuit, a conclusion is reached that the currents I_1 and I_2 measured by the ammeters A_1 and A_2 is equal to the current I measured.

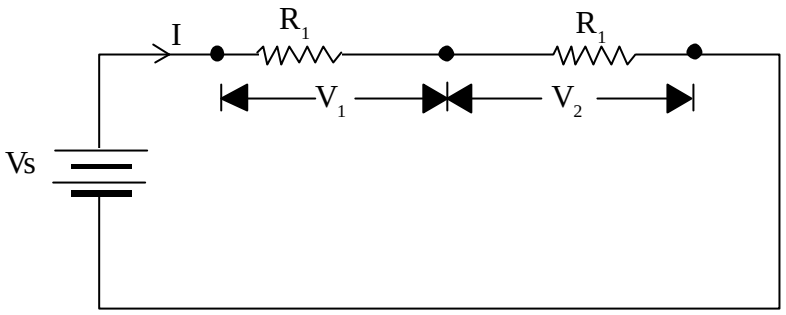
- Kirchoff's current law states that the algebraic sum of current is equal to Zero.

Activity.2

1.4.2 Kirchoff's Voltage Law

Materials Required

1. Two resistors
2. Battery
3. Multimeter



Demonstration

- Let the students observe circuits consisting of the voltage source Vs resistors R_1 & R_2. Measurement and the voltage drop V_1 & V_2 using a multimeter.

Consolidation

Kirchoff's voltage law verified.

1.5 Fundamentals of AC

1.5.1

Activity.1

- Recollection of previous knowledge
- Collection of previous knowledge about alternating current, its changing value and direction.

Demo by CRO

An AC waveform is displayed in a CRO and illustration is given by the teacher.

Consolidation

- Concepts of of peak value, R. M. S value, average value, cycle, period, frequency of AC.
- Plotting of AC wave form by each student.
- State the above parameters.

1.6 Magnetism

Activity.1
Group Discussion

- Previous knowledge about magnetism is discussed and emphasis is given to the following points.
- Magnet
- Poles
- Magnetic Field
- Electromagnet
- Difference between permanent magnet and elecromagnet
- Suspension of bar magnet in air

Consolidation

- Give the concepts in the form of statements about magnetic field, magnetic flux, flux density with units.

Activity.2

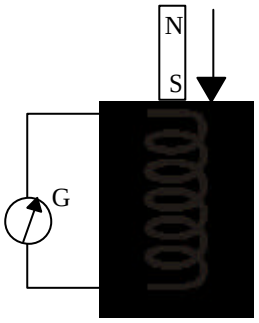
- An activity can be given by doing experiment using bar magnet, iron filings and compass.

Consolidation

Phenomenon associated with magnetic fields.

1.7 Electromagnetic Induction

Activity
Experiment- Coil Magnet Experiment



Material Required

Solenoid, Magnet, Galvanometer.

Procedure

A solenoid is connected to a sensitive galvanometer as per the circuit diagram. When a magnet is moved towards the coil, the galvanometer shows a deflection. When the magnet is moved away from the coil, the galvanometer shows a

deflection in the opposite direction. The deflection become larger, when the magnet is moved faster. When the magnet is stationary, no deflection can be observed. The same effect can be observed when the coil is moved, keeping the magnet stationary.

Inference

When there is a relative motion between the coil and the magnet, the galvanometer shows a deflection, which means an e.m.f is induced in the circuit.

Consolidation

The above experiment clearly demonstrates the phenomenon of electromagnetic induction.

1.7.1 Faraday's Law

Based on Faraday's experiment, the laws are;

1. Whenever the magnetic flux linked with a circuit changes, a change in e.m.f is induced in it. The induced e.m.f lasts only so long as the magnetic flux is changing.
2. The magnitude of the induced e.m.f is equal to the rate of change of magnetic flux linked with the circuit.

If the magnetic flux linked with a circuit changes by df in a small time dt, then the magnitude of the induced e.m.f also changes.

1.7. 2 Self Induction and mutual induction

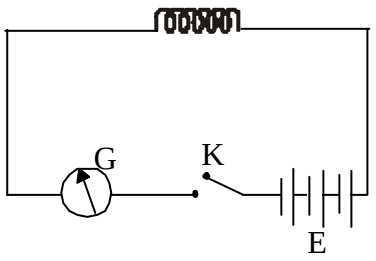
Self induction

Activity

Demonstration and Discussion.

Materials Required

Solenoid, Battery, Key, Galvanometer.



Demonstration

Consider a solenoid connected to a battery and a switch K. When the switch is

pressed the current flowing through the coil increases the magnetic flux in the coil from Zero to a maximum value. This change in magnetic flux induces an e.m.f in the coil. The direction of this induced e.m. f is opposite to the main e.m.f E applied and hence this induced e.m.f is called back e.m.f. This back e.m.f opposes the growth of current in the circuit.

When the switch is opened the magnetic flux linked with the coil decreases to zero. This again induces a large e.m.f in the coil which opposes the decay of current in the circuit. Thus both growth and decay of current in a circuit are opposed by the back e.m.f.

Inference

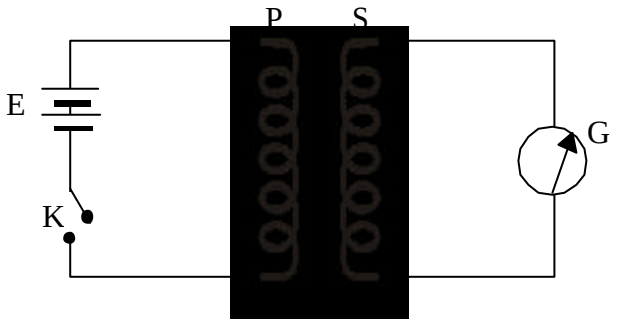
The reason for the slow movement of the needle is that as the current flows through the coil, the magnetic field setup by it links with the rest of the coil and hence induces a current. When the switch is off, the induced current decreases as the magnetic flux decreases. The direction of induced e.m.f due to the self induction is reversed.

Consolidation

The phenomenon due to which a current flowing through a part of coil induces an e.m.f in the rest of the coil due to the change in magnetic flux is called self induction.

Mutual induction
Activity

Demonstration and discussion



Materials Required

Two solenoids, Battery, Key, Galvanometer.

Demonstration

Consider the two solenoids primary and secondary are placed close to each other. The primary P is connected to a battery and tap key K while secondary S is connected to a sensitive Galvanometer G.

Inference

When switch K is turned ON, the change of current in primary changes the magnetic flux linked with secondary coil S. Hence an e.m.f is induced in the secondary and the galvanometer shows a deflection. Similarly when the key is opened the galvanometer shows a deflection in the opposite direction.

Consolidation

The phenomenon of production of an opposing e.m.f in a circuit due to the change in current or magnetic flux linked with a neighbouring circuit is called mutual induction.

1.8 Transformers

Activity.1
Demonstration- Illustration- charts, CD's, Slide show

- Discuss the principles of mutual induction
- Transformers
- Demonstrate a transformer and specify its necessary features.

Observation

- The primary winding and secondary windings are identified.
- Measure the primary winding resistance and secondary winding resistance.
- Identify the types of transformer.
- Note the voltage rating and ampere rating from the label.

Activity. 2
Chart Preparation

Students are directed to prepare the following chart.

- Symbol of transformer
- Simple constructional diagram
- Step-up and Step-down transformers.
- Symbol of Auto transformer

Activity. 3
Assignment

An assignment consisting of the following topics;

- Principles of transformer
- Transformer equation
- Symbol of transformer
- Classification and types of transformer.
- Transformer losses.

Consolidation

- Principle- mutual induction.
- Basic concept of construction and working. (Step-up and step-down)
- Turn ratio, current and voltage equation.
- Basic idea of transformer classification according to construction and working.
- Simple diagram and symbols of transformer.
- Simple problems can be given based on transformer equations.
- Conclude that transformer is a device which transfers energy from one circuit to another without change in frequency of the AC but with a change in voltage and current. Therefore transformer can be used to increase or decrease the voltage level of a source.

Record Work

Documentation of transformers, working, different types, applications and evaluation.

Subject : Maintenance and Operation of Biomedical Equipment

Unit. 1 : Basic Electricity

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
1.	Basic idea about electricity	Recollect and reproduce previously acquired knowledge. Units, Diamensions and Symbols.	Inquisitiveness Elicit response. Communication. Clarity of the concept.	Questioning. Group discussion. Collection of data. Reference. Brainstorm-ing.	Reference book. Library book. Periodicals. Internet. C.D, Slides	Interest. Memory skill. Data collection ability.	20	40
2.	Acquire fundamental knowledge regarding basic electricity and magnetism.	Differentiate between AC and DC voltage and currents. AC fundamentals. Field and flux density. Laws of E.M. I	Comparison. Observation. Communication. Developing.	Demonstra-tion. Graphical representa-tion. Experiment. Chart. Discussion.	C.R.O Signal Generator. Cell, bulb Magnet. Coil. C.D, Slides.	Oral test. Class test. Data. Practical Evalua-tion.		

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
3.	To establish the relation between voltage, current, resistance and also distribution of voltage and current in a circuit.	Ohm's law. Kirchoff's laws. Laws of resistance.	Developing relationship. Comparison. Problem solving.	Discussion. Diagrams. Equations. Demonstration using simple experiments. Simple problem.	Cell. Wires. Resistors. Bulb. Multimeter. Connecting boards.	Class test. Oral test. Practial Evaluation.		
4.	To familiarise transformers.	Self and mutual induction. Working principle. Types.	Identification Problem solving. Observation from chart models. Testing.	Discussions. Identifications. Problems. Testing.	Different types of transformers. Multimeter.	Oral test. Practical Evaluation.		

2 BASIC ELECTRONICS

Introduction

Electronics is a branch of engeneering which deals with flow of electrons through air vacuum or freespace.

Developments in the field of electronics has revolutionised the eletronic devices and it has become very essential part in our daily life. Hence a priliminary idea about the field is essential to all. In the lower classes students have learned the concept of atoms, their structure and various basic ideas of electronics.

We know that everyone is familiar with electronic devices such as radio, Television, Computer, Mobile phones etc. But most of them are not aware of what is happening inside these devices.

This chapter deals with the various voltage sources, electronic components, semiconductors, diodes, Transistors, Integrated circuits (IC) and microprocessors. From the primitive spark gap transmitters at the turn of the century, we have passed through vacuum tube era to a solid state era. These advancements made the gigantic ENIAC into Palmtop. IC's to L.S.I to V.L.S.I.

Curriculum Objectives

- To familiarise and distinguish between ideal and real voltage sources.
- Basic concept about direct and alternating voltage sources.
- To distinguish between active and passive components.
- To familiarise resistors and develop knowledge of different types and colour coding of resistors.
- To familiarise capacitors and different types.
- To grasp basic ideas of series and parallel connection of resistors and capacitors and find out their applications in electronics.
- To familiarise Inductors and their classifications.
- To distinguish various substances depending on energy bands with examples.
- To acquire knowledge about properties of semiconductors and their applications.

- To group the aspects of change in electrical properties according to impurity addition.
- To acquire knowledge about PN junction and to understand the importance of biasing.
- To create awareness about the relationship between voltage and current through a PN junction.
- To familiarise zener diode and its applications.
- To acquire knowledge about transistor, types symbols and working.
- To acquire knowledge about transistor connections and their applications.
- To get basic ideas about FET, SCR and their working.
- To obtain an overview about IC's and microprocessors

Syllabus

Introduction to electronics

Concepts of ideal and real voltage sources- Direct and Alternating voltage sources- Examples.

Electronic Components

Active and Passive Examples.

Resistors

Resistance- unit- symbol- resistivity- colour coding- types (fixed and variable) series and parallel circuits- simple problems.

Capacitors

Capacitance- unit- symbol- types (fixed and variable) series and parallel connections- simple problems.

Inductors

Inductance- unit- symbol- types (according to core and frequency)

Semiconductors

Energy band diagrams of insulator, semiconductor and conductors- Examples- properties of semiconductor- P-types and N-type semiconductors.

P N junctions

P.N junction formation- symbol properties- Biasing- VI Characteristics- PI V- Knee voltage- break down voltage.

Zener diode

Basic concept- symbols, uses.

Transistors

Basic structure- symbol- types (PNP and NPN)- working- transistor as an amplifier- transistor configuration (only circuit details)

F.E.T

Structure- symbol- working- uses

S.C.R

Structure- symbol- working- uses

IC's

Basic concept- Advantages- Applications

Microprocessor

Basic ideas- Significant applications.

2.1.1 Voltage sources and ideal Voltage sources

Activity.1
Demonstration

- Show maximum available voltage soures, such as cells, Batteries, rechargable cells, AC generators, Eliminators etc.
- Allow the students to observe each and every one in detail and prepare notes.
- Show the polarities of D.C sources.

Discussion

- Ask the learners to read aloud the points noted in their books.

Discussion points

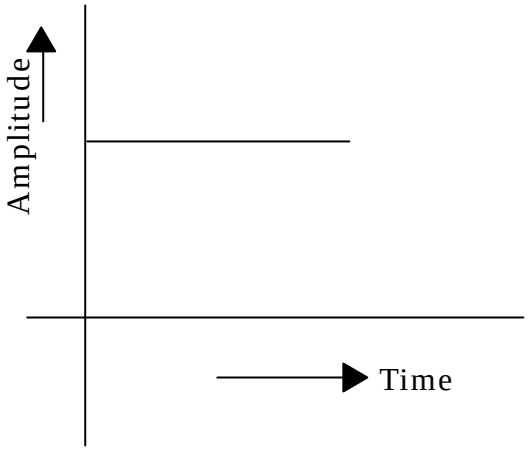
- Daily uses of voltage sources.
- Varifies in physical size and voltage.
- Comparison of cost and size.
- Latest advancement.
- Specific classification.

Consolidation

A voltage source is a device that produce electricity by converting some form of energy into electrical energy. There are two types of voltage sources. Direct and Alternating.

Direct Voltage Source

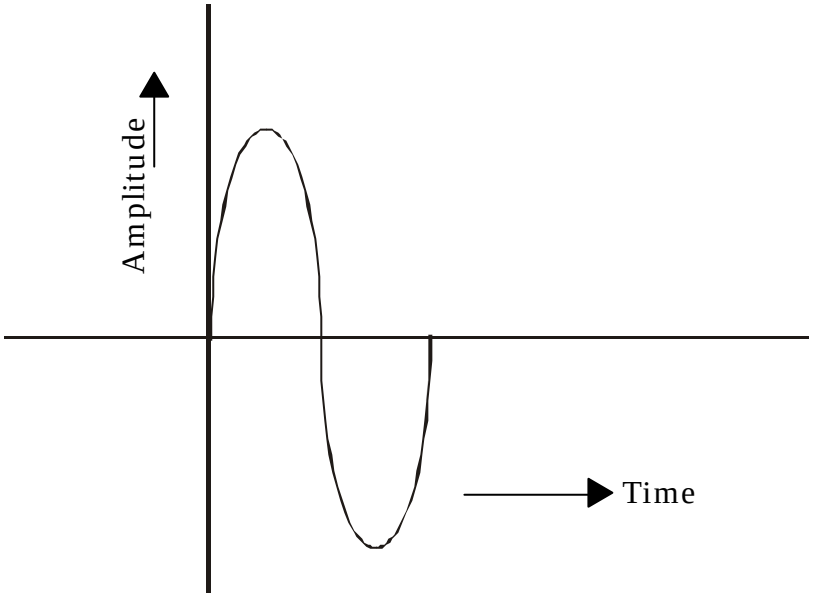
The device which provides steady direct voltage output continuosly is called a DC voltage source. Examples are cells, D.C generators etc, The polarity of the d.C output voltage remains constant.



Graphical representation of D.C

Alternating Voltage Source

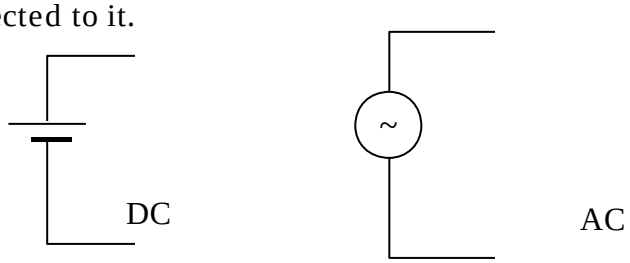
The device which produces alternating voltage output continously is known as alternating voltage source. Examples are AC generators, Oscillators etc. The polarity of alternating voltage source is continuously changing.



Graphical representation of A.C

Ideal Voltage Source

A voltage source having zero internal resistance is called ideal voltage source Ideal voltage source should provide a fixed terminal voltage whatever be the load connected to it.



Symbolic representation of AC and DC.

2.2 Electronic components

Activity.1
Exhibition of components

- Show maximum available components both active and passive to students.
- Allow them to observe and note all the observed points.
- At last divide the students to group's having a maximum of 3 numbers and give them a few components and aks to group them into active and passive.

Consolidation

- The student should get clear cut idea about the classification of electronic components, concepts and examples for each.
- Classification of electronic components
- Electronic components are elements which make up an electronic circuit. They can be classified into two; 1. Active and 2. Passive component.

Passive component

Component which are not capable of amplifying or processing an electrical signal by themselves are called passive components. Examples are Resistors, Capacitors and Inductors.

Active Component

Components which are capable of amplifying or processing by themselves are called active components. They can be classified into two; Tube devices and semiconductor devices. Examples are Vacuum diodes, P- N junction diode, Transistor, FET, SCR etc.

2.3 Resistors

Symbols, types and colour coding

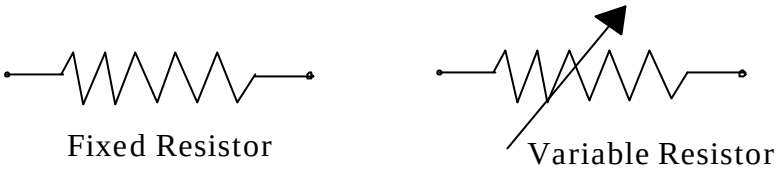
Activity.1

- Show the maximum available resistors both fixed and variable.
  Example; Carbon resistors, Wirewound resistors, Potentiometer, Rheostat etc.
- Allow and encourage them for keen observation of each and every component.
- Persuade them for preparing the observation notes.
  (Size, terminals, printed matters on the components etc)
- Give them few components and instruct them to group the given resistors in to fixed and variable. Also prepare coloured in the notes.

Consolidation

The property of a material to oppose the flow of current through it can be called as resistance. The unit is 'ohm'. Resistor is a passive component with a specified value of resistance.

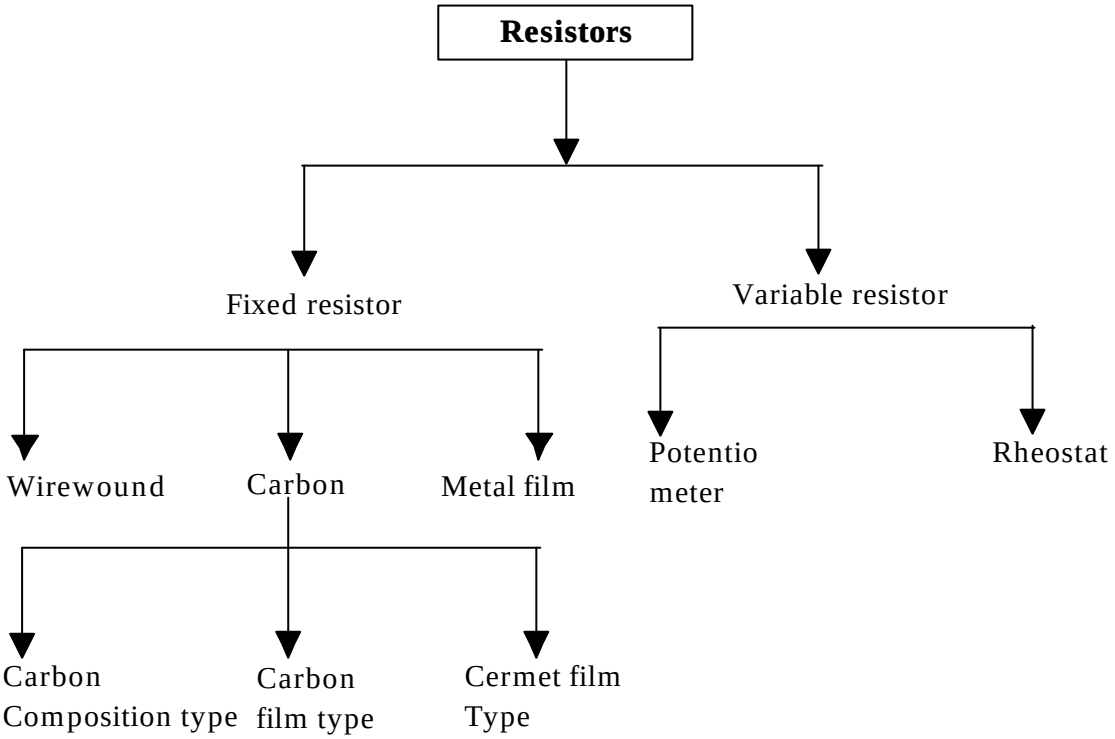
Symbols



Activity. 2
Chart Preparation

- Give instruction to students for preparing chart.
- Chart should contain different types of resistors (only the names)

Model Chart



- Display the chart in the class room

Activity. 3
Exhibit different types of resistors

- Show the different type of resistors
- Show the different types of resistors listed in the chart.
- Allow them to have keen observation.
- Instruct the students to draw charts for all exhibited components.

Consolidation

Resistors are mainly two types fixed resistor and variable types.

Fixed resistors

Value of there resistance are fixed. They can be classified in to three;

1. Wire wound resistor.
2. Carbon resistors .
3. Metal film resistors.

Again carbon resistors are three types;

1. Carbon composition type.
2. Carbon film type.
3. Cermet ceramic type.

Variable Resistors

Variable resistors are resistors whose resistance value can be varied from zero to maximum value. Variable resistor can be of two types.

1. Potentiometer
2. Rheostat

Activity. 4

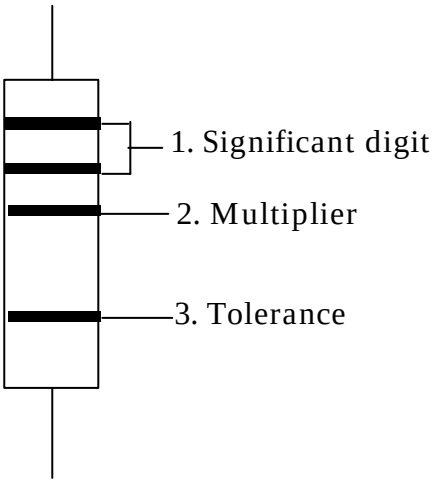
Chart Preparation

- Chart should contain different colours used for coding and their corresponding values.
- Use appropriate sketch or marker pen for each colours (Black sketch for Black colour)

Chart- II

- Chart Should contain the enlarged diagram of a colour coded carbon resistor with marked bands.
- Marked out examples for colour coded value. Calculations should be given in the chart.

Model chart



Colour coding of Resistors

The resistance value and the possible variation in value from the coded values are indicated by colour code. Colour bands are printed on the body of a resistor. near its one edge and readings from left to right.

- Show the colour coding table.

The possible variation from the standard value can be called as Tolerance.

Commonly there are four colour bands in a resistor. First three colours give the value of resistance and the fourth band is used for tolerance. The first colour band indicates the first digit of the resistance value, second band is the second digit and third band indicate the decimal multiplier (That is the number of zeroes to be added after the two digits.)

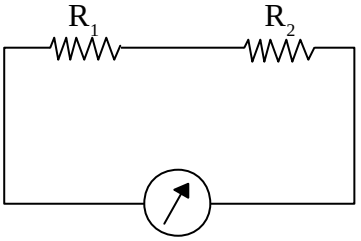
- Record work on resistors- different types- color coding of resistors with examples and evaluation.

2.3.2

Series and Parallel combination of resistors

Activity

- Give two resistors and allow the students to findout the values of resistors using ohm meter.
- Connect the two resistors as shown the figure and note the ohm meter reading.

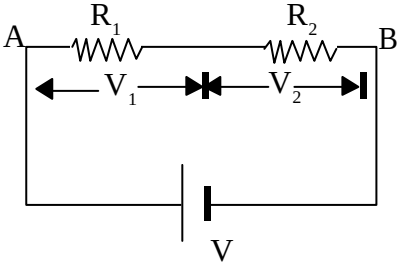


- Guide them to find the relation between first and second reading. ($R = R_1 + R_2$).

Consolidation

The resistors can be connected in two ways- series and parallel. The total resistance of a given circuit is called equivalent resistance or effective resistance

Resistors are said to be in series if connected one after the other so that the current flow is same through each resistor.



Consolidation

The resistors can be connected in two ways series and parallel. The total resistance of a given circuit is called equivalent resistance or effective resistance. Resistors are said to be in series if connected one after other and to end so that the current flow is same through each resistor.

Current through the resistors is the same IA. If V_1 and V_2 are the potential difference of R1 and R2 then

$$V1 = IR_1$$

$$V2 = IR_2 \text{ (by Ohm's law)}$$

$\therefore$ Total potential difference between A and B is the sum of individual voltages and it is 'V'

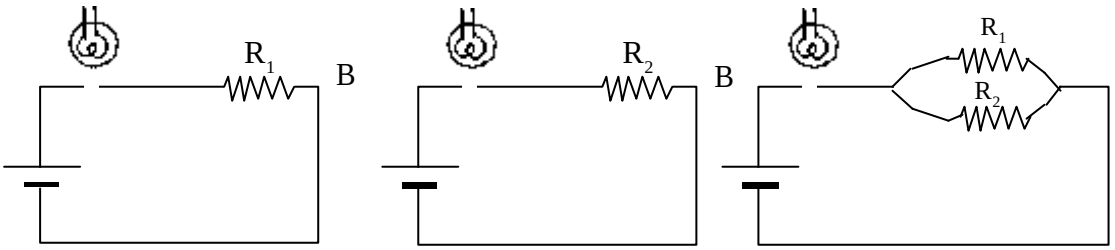
$$\therefore V = V_1 + V_2$$

$$IR = IR_1 + IR_2 \text{ (by Ohm's law)}$$

$$\therefore R = R_1 + R_2$$

Thus when resistors are connected in series effective resistance is the sum of individual resistances.

Activity.10
Parallel circuit



(1) (2) (3)

- Allow the learners to observe and note the change in brightness of lamp.
- Give the idea of increase in current and hence decrease in resistance in resistance when they are connected in parallel.

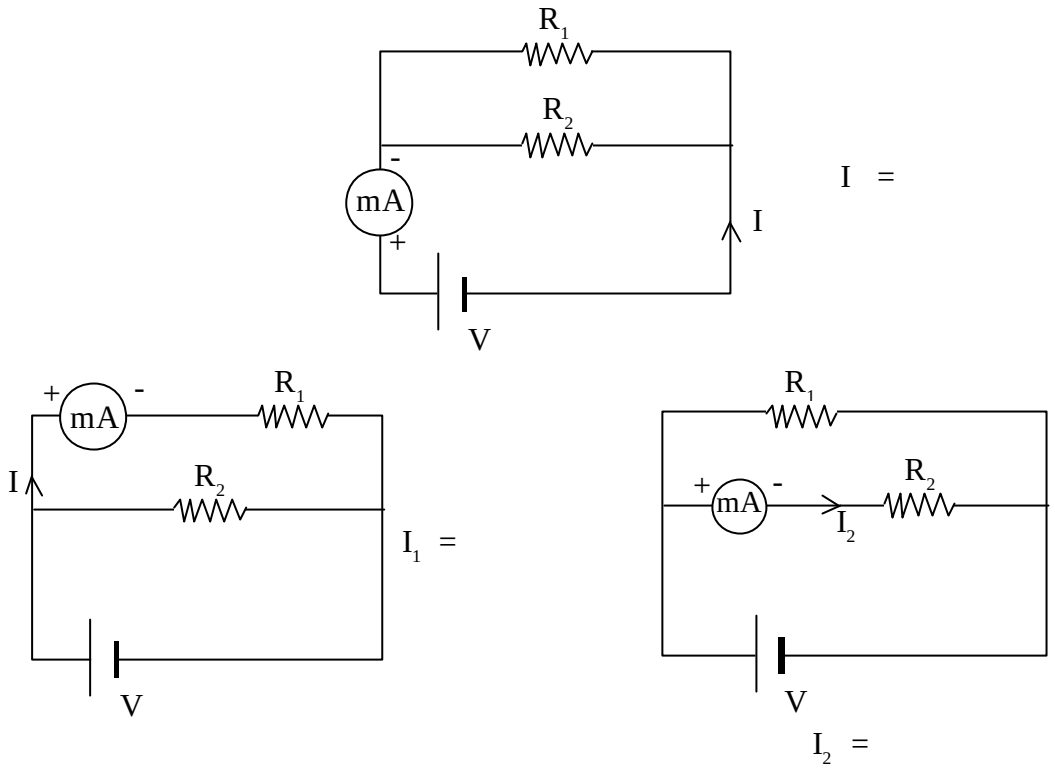
Consolidation

In parallel the effective resistance is less than the least of the individual resistors.

Activity. 11

Connect the resistors with voltage source some as shown in figure.

- Note the values of I, I_1 and I_2
- Make the students aware of the relation between I, I_1 and I_2 $(I = I_1 + I_2)$



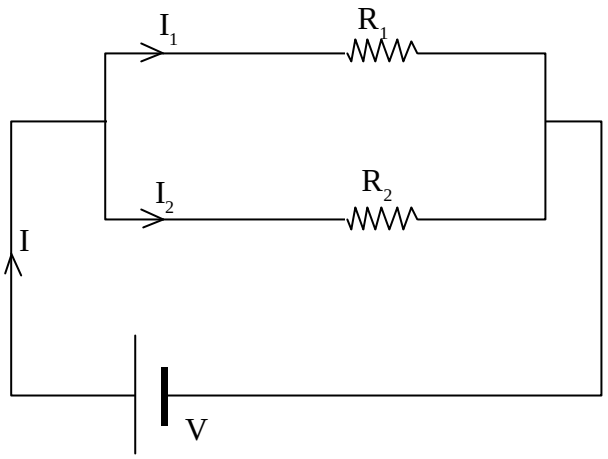
- Review the Ohm's law equation V = IR.
- Ask the students to replace the equation of I by the equation for I in Ohm's law $(I = \frac{V}{R})$
- Guide the students to the final equation $\frac{V}{R} = \frac{V_1}{R_2} + \frac{V_2}{R_2}$ - (1)
- Make the idea that voltage across each resistors are same ie, $V_1 = V_2 = V$
- Re write the equation (1)
- $\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2}$ (2)
- Ask the students to simplify the equation (2)
- Guide the students to final equation

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

Consolidation

Resistors in Parallel

Resistors are said to be in parallel when end of each resistors is connected to a common point. Now resistors is connected to a common point. Now the potential difference across each resistor is the same and the total current is distributed among the resistors. So the current through each resistor will be different.



Current equation for the circuit is

$I = I_1 + I_2$

by ohm's law $I = \frac{V}{R}$ substituting this in above equation.

$$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\frac{V}{R} = V\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

$$\therefore \frac{1}{R_1} = \frac{1}{R_1} + \frac{1}{R_2}$$

Thus when resistance are connected in parallel the reciprocal of the equivalent resistance of the combination is the sum of the reciprocals of individual resistance.

- Give simple problem for both paralell and series circuits.

Capacitors

Activity. 12
Exhibition of Capacitors

- Show the available capacitors both fixed and variable.
- Example; Ceramic capacitor, Paper capacitor, Mica capacitor, Electrolytic capacitor, Ganged capacitor, Trimmer capacitor, Padder capacitor.
- Motivate then for keen observation of each and every component.
- Persuade them for preparing the observation notes. (size, terminals, printed mattter on the components etc.)
- Give them few components and instruct them to group the given capacitor into fixed and variable, electrolytic and nonelectrolytic and prepare columns in the notes.
- Dismandle an old electrolytic capacitor
- Show to the students constructional details of capacitor and let them prepare notes.

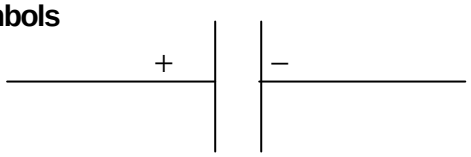
Consolidation

Capacitor

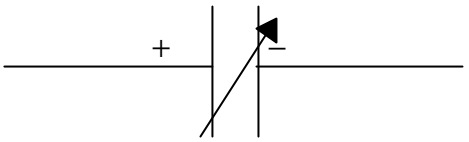
Capacitor is an electronic component used in electronic circuit which has the ability to store electric charge, opposes any change of voltage in the circuit in which it is connected and block the passage of DC through it.

Capacitor consists of two conducting plates separated by an insulating medium such as air, mica, Ceramic etc. The insulating medium b/w the plates is called dielectric material.

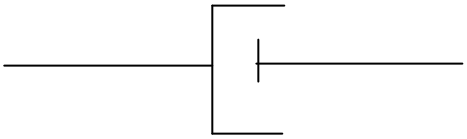
Symbols



Fixed Capacitor



Variable Capacitor



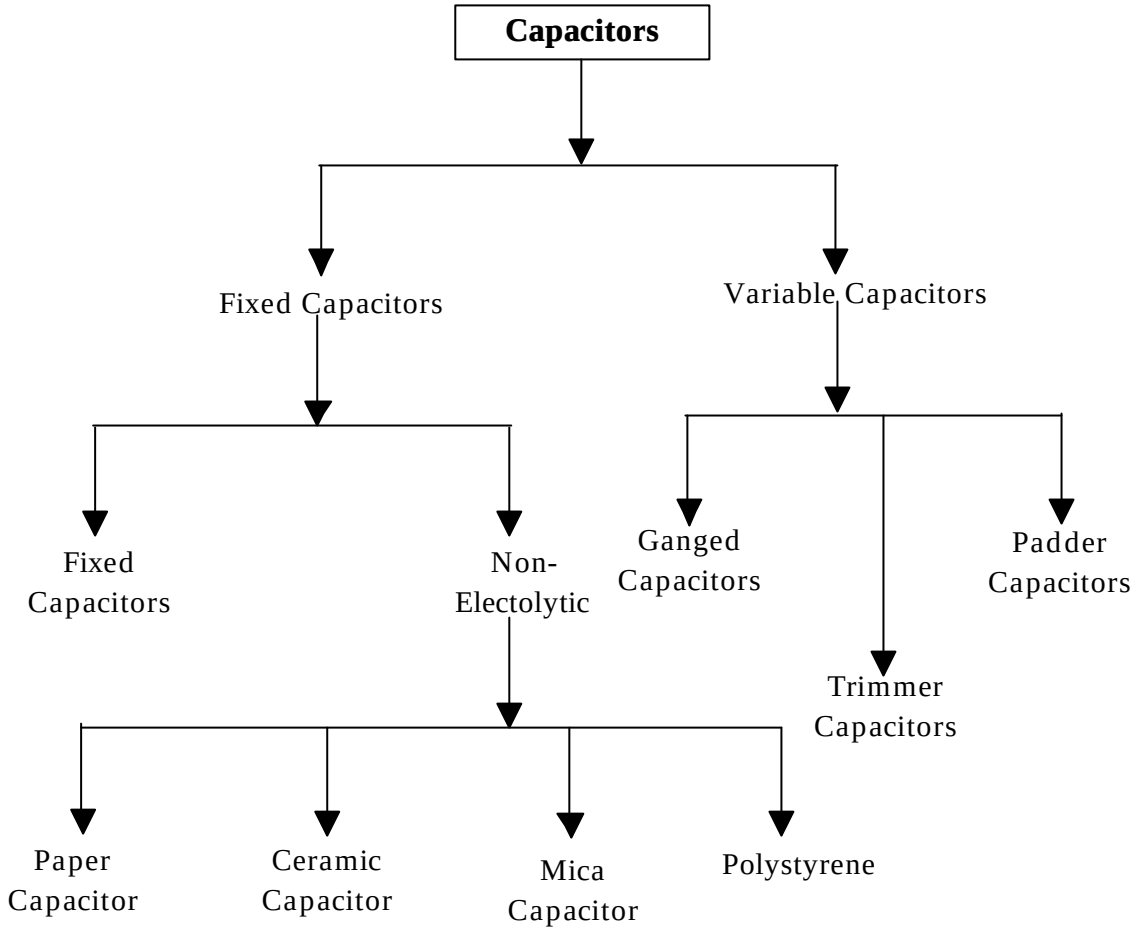
Electrolytic Capacitor

Activity.13
Chart Preparation

- Give instruction to students for preparing chart.
- Chart should contain different types of capacitors (only the names)

Model chart

- Display the following chart in the class room.



Activity

- Exhibition of different types of capacitors
- Show different types of listed in the chart
- Motivate them for keen observation
- Instruct the students to draw all the exhibited components.

Consolidation

Types

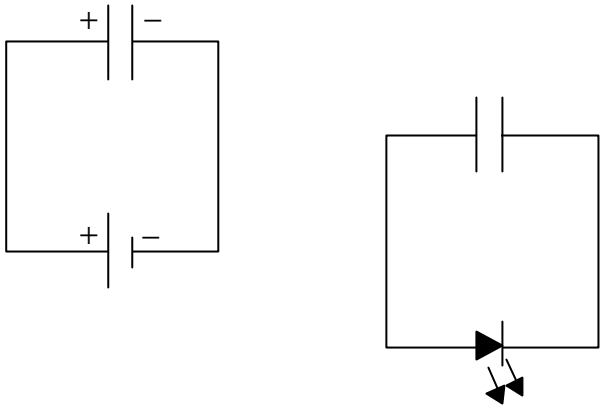
Capacitors can be generally be classsified into two fixed and variable.

Fixed capacitors are those whose cpacitance can't be varied and they can furthur be divided in to electrolytic and non electrolytic. Non electrolytic capacitors can be of three types of ceramic, paper and mica.

Variable capacitor is one whose capacitance can be varied. They can be of three types gang capacitor, Trimmer and Padder.

Activity. 14
Demonstration

- Connect the capacitor to DC voltage sourceas shown in figure.
- Then disconnect the voltage source and connect the capacitor with a LED.



- Motivate the students to note and their observation.
- Allow the students to do the demonstration batch ways.

Consolidation

The process of storing electricity in a chapter is called charging. The process of releasing stored electricity from the capacitor is called discharging.

Capacitance is the ability of a capacitor to store electric charge and the unit is 'Farad'.

$$\text{Capacitance } C = \varepsilon A / d$$

The maximum potential that can be applied across the plates of a capacitor without damaging is known as voltage rating of capacitor. The oppostion force offered by a capacitor to an AC is called capacitive reactance and the unit is 'Ohm'.

$$\text{Capacitive reactance } X_C = \frac{1}{2pfc}$$

Activity. 15
Discussion

Discussion points

- How to connect the series and parallel (ciruit diagram of series and paralell and combination)
- Characteristics of series and parallel.
- Need of conncetions
- Equivalent capacitance.

Consolidation

- Capacitors can be made as circuit elements in three ways.

- Series, parallel and combination
- In a series circuit reciprocal of the total capacitance is equal to the sum of the reciprocals of individual capacitances.

$$\text{ie, } \frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots$$

- In a parallel circuit the total capitance is the sum of individual capacitances

$$C = C_1 + C_2 + C_3 + \ldots$$

- Simple problems only.

Inductors

Activity. 16
Demonstration

- Construction of simple coil by winding a conductor as a solenoid.
- Show different varities of inductors available.
- Motivate the learner for keen observation, preparing notes and sketches.
- Just mention different types,their use and symbols.
- Just mention what is inductance.

Consolidation

- Inductor is an electronic component used to store electric energy as magnetic field.
- Inductor is manufactured by winding a wire in a core or a frame of suitable material. Example for core materials are , Ferrite, Iron etc.
- Inductors can be of different types and can be classified according to;
  1. Core materials are used.
     a. air core
     b. Iron core
     c. Ferrite core
  2. Frequency
     a. Audio frequency (AF)
     b. Radio frequency (RF)
  3. Method of winding
     a. single layer winding
     b. Multi layer winding
  4. Accoring to use
     a. Fixed
     b. Variable

- Inductance is the ability of a condcuctor to oppose any change in current through that conductor.

Semi Condcutors

Activity. 17
Group Discussion

Discussion points

- Re- collect the previous knowledge
- Comparison between conductor, semiconductor and insulator with examples.
- Conductivity, resistivity, negative temperature co-efficient of resistance.
- Need of semiconductor.

Consolidation

- Semiconductor is a material which is neither a good conductor nor an insulator.
- Semiconductor behaves as pure insulator at low temperatures. At high temperature due to thermal energy some electrons get free at the conduction band and thus limited conduction is possible.
- Examples are Ge and Si.
- Properties of semiconductor.
  - Resistivity and conductivity of a semiconductor lies in between that of a conductor and an insulator.
  - Semiconductors have negative temperature co-efficient of resistance ie, resistance decreases with the increase in temperature.
  - When suitable metallic impurity is added the current conducting properties change appreciably.

Activity. 18
Chart Preparation

- Chart contents
  - Energy band diagrams of conductor, semiconductor and insulator.
  - Crystalline structure of pure semiconductors (Ge or Si)
  - Crystalline structure of impure (Extrinsic) semiconductor (Both N-type and P- type.)
- Display the chart and discuss.

Consolidation

- Compare energy band diagram of conductor, insulator and semiconductor and their properties.
- Band formation in pure semiconductor (Ge or Si).
- Changes in electrical properties due to the addition of metallic impurities.
  - Donor doping
    - Donor impurties- example.

- Acceptor doping
  - Acceptor impurities- example.
- N- type and P- type semiconductors.
  - Formation, majority and minority carriers and uses.
  - PN junction.

Activity. 19
Discussion

Discussion points

- Recollect the ideas about P-type and N-type semiconductors.
- What happens when combining N- type and P- type semiconductors.
- What is recombination and what happens to the corresponding atoms when recombination taking place?
- What is depletion layer and how is it formed.
- Knee voltage or Barrier potential.

consolidation

- Structure and symbol of PN junction
- Formation of PN junction
- Properties of PN junction
  - Diffusion
  - Recombination
  - Depletion layer
  - Barrier potential and knee voltage.

Activity. 20
V-I Characteristics of PN junction Diode

Demo

- Collection of materials and equipments
- Testing of components
- Fabrication of circuit with the help of circuit diagram both forward and reverse.
- Demo by the teacher.
- Observation in columns.

Consolidation

- Concepts of forward biasing and working with suitable diagram.
- Concept of reverse biasing and working with suitable diagram.
- Concept of knee voltage, Reverse saturation current, PIV and Break down voltage.
- V-I characteristics curve.

Zener Diode

Activity. 21
Discussion

- What is reverse biasing?
- What is zener breakdown?
- Concept of zener diode.
- What are the differences between zener diode and ordinary diode?

Consolidation

- Concept of zener breakdown and zener voltage
- Symbol of zener diode.
- Working of zener diode (Both forward and reverse)
- V- I characteristics curve.
- Mention uses.

Transistors

Activity.22
Discussion

Discussion points

- What is PN junction?
- What happens when an additional N- type or P- type crystal is added to a PN junction?
- What are the terminals of a transistor?
- What are the different types of transistors?

Consolidation

- Structure and terminals of transistor and functions of each terminal.
- Types of transistor (PNP and NPN) and their symbols.

Activity. 23
Illustration

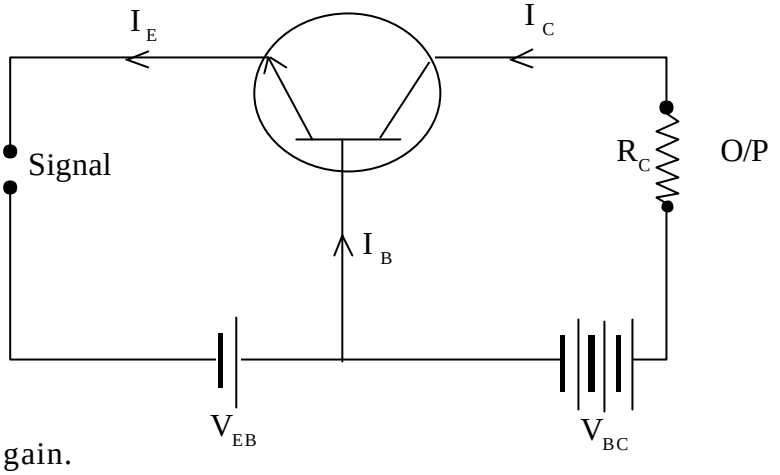
- Biasing of transistor
- Working of transistor with diagrams
- Current equation ($I_E = I_B + I_C$)
- Transistor connection CE, CB and CC (Circuits only)

Activity. 24
Demonstration

- Connect transistor as an amplifier (with any simple circuit diagram)
- Show I/P and O/P wave forms in CRO.
- Allow the learners to observe and prepare necessary notes.

Consolidation

- Working of transistor as an amplifier.



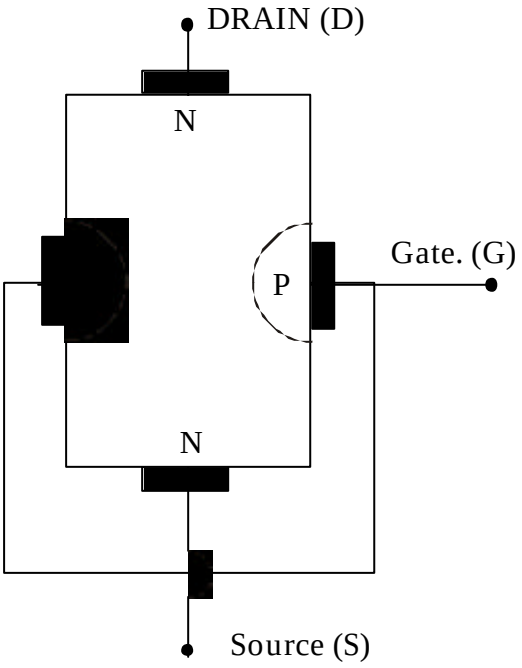
- Concept of gain.
- Cirucit diagram

Activity. 25
Chart Preparation

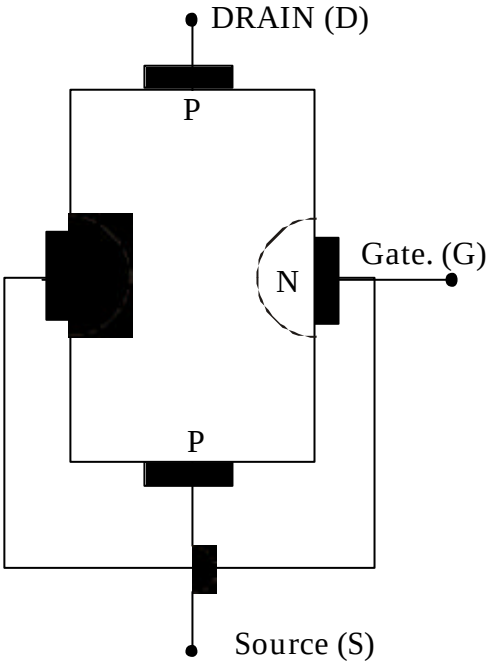
- Chart should contain transistor structure, symbols, transistor connection, circuit diagram of transistor as an amplifier.
- Display the chart in the class room.

FET

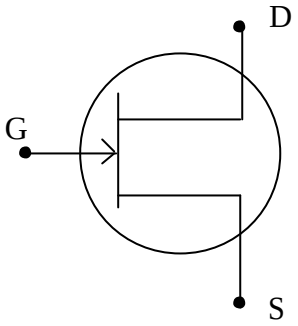
Activity. 26
Illustration with exhibition



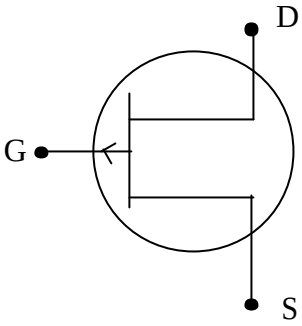
N- Channel FET



P- Channel FET



Symbol of
N- Channel FET

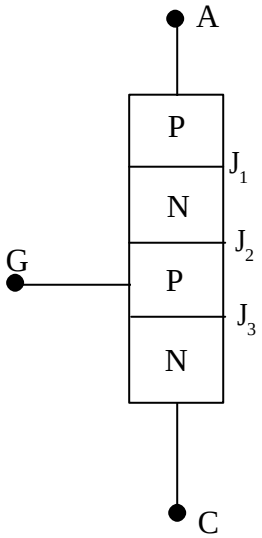


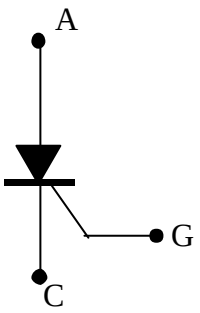
Symbol of
P- Channel FET

- Structure of FET (P- Channel and N- Channel) with diagrams.
- Symbols of both P- channel and N-channel.
- Basic concept of working.
- Mention uses.
- Show an a FET and let the learners to observe and prepare notes. (Sketch the diagram, terminal)

SCR

Activity. 27
Illustration with exhibition





- Structure of SCR and Symbol
- Basic concept of working.
- Mention uses.
- Show an SCR and let the learners to observe and note the necessary points (Sketch the diagram, terminals).

Integrated cirucits

Activity. 28
Exhibition

- Show all available types of IC's.
- Motivate the learners to identify the differences of different IC's (Number of pins, printed matters on IC's, physical size.)

Consolidation

- Basic concept of IC's and advantages.
- Mention uses.

Microprocessors

Acvtivity. 29
Illustration with exhibition

- Basic concept of microprocessor.
- Mention uses.
- Merits.
- Show any microprocessor available, learners to observe it.

Activity. 30
Collection

Collection of components and IC's

- Instruct the learners to collect maximum numbers of components and IC's and to bring them to the class room.
- Ask them to identify and group according to their varieties. (eg; Diodes, Resistors, Capacitors, Inductors, IC's, Microprocessors, Transistors, FET's, SCRs.....)
- Ask them to check all the grouped components (Resistor, capacitor, transistor, diode, inductors and FET)

Consolidation

- Convey the idea of checking the following components.
  - Resistor
  - Capacitor
  - Inductor
  - Diode
  - Transistor
  - FET

Activity. 31

- Slide show
- CD's show on electronic components
- Internet

Subject : Maintenance and Operation of Biomedical Equipment

Unit. 2 : Basic Electronics

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
1.	To familiarise electronic components.	Active and passive. Electrical materials.	Distinguishing capacity. Classification. Observation.	Observation. Identification. Discussion. Assignment. Chart preparation.	Passive components. Active components.	Practical Evaluation (Spotting) Oral Test. Report Evaluation.	35	80
2.	To acquire knowledge about semiconductor physics.	Properties. Examples. Types.	Comparison. Classification.	Diagrams. Discussion.	Library books. Reference books. Internet.	Oral test. Practical Evaluation.		

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
3.	To develop a concrete idea of PN junction diodes and various aspects related to it.	PN junction. Formation. Working. Types and symbols.	Identification. Classification. Observation.	Experi-ments. Demonstra-tion. Diagrams. Testing (Demo) Discussion. Assignment.	Library books. Reference books. Diodes. Multimeter.	Practical Evalua-tion. (Spotting) Class test. Oral test. Assign-ment.		
4.	To acquire knowledge about transistors.	BJT- NPN- PNP JFET Construction and working. Symbols.	Comparison. Identification. Classification. Observation.	Diagrams. Testing (Demo) Discussion. Seminar.	Library Books. Reference books. Transistors. Multimeter.	Spotting. Class test. Oral test. Presenta-tion. Report.		

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
5.	To familiarise silicon controlled rectifiers.	Symbols. Working principles.	Identification. Communication. Observation.	Diagrams. Discussion. Chart.	Library books. Reference books. SCR.	Spotting. Class test. Oral test.		
6.	To acquiant Fundamentals of integrated circuits and microprocessors.	Basic Idea. Types.	Different types of IC's. Identification of IC's and its different uses.	Collection of different types of IC's.	IC manuals, Reference books.	Spotting. Oral test.		

3 MEASURING INSTRUMENTS

Introduction

From the earlier chapters the students should have known that in electronics most of the theoretical aspects have to be practically verified. These experiments are to be evaluated based on the values obtained through measurements. Similarly the student during his course of study comes across a variety of electrical and electronic components and devices. Those devices and components have to be checked to see, if they are fit to be used. Sometimes their values should be known. All these involves the common and most principal aspect of the scientific method namely accurate measurement followed by observation, result presentation in appropriate units and drawing correct inference from the result. The process of measurement require a suitable measuring instrument which is reliable and easy to use. The students come across many testing, measuring and indicating instruments in the laboratory. The students are supposed to know the application of each instrument, specific use handling of the instruments, basic knowledge about the control panel and their operation. At the same time it is essential that they are aware of the requirements that the instrument should fullfil.

Ammeter, Voltmeter, Multimeter, CRO and Function generator are the measuring instruments discussed briefly in this chapter. Acutally the students would have already learned a little about ammeter and voltmeter. Galvanometer being the basic to most of the instruments used for currernt detection, its basic concept is known. Then we have to find the use of galvanometer as ammeter, voltmeter, and ohmmeter separately. Multimeter is a multipurpose measuring insturment in which the circuits of the above three instruments are combined.

CRO is being discussed next with a brief description about its working, front pannel controls etc. Only very short and brief description of the signal generator is given. Application, merits and demerits of the instruments are a must in biomedical lab. Students should have ample opportunity to be exposed to various aspects of these instruments. They can be throughly familiarised with using the instruments for checking electrical parameters, components, observation of waveforms and various other uses in electronic circuits trough various experiments. Apart from these they can be asked to prepare charts or given assignments. They can be evaluated primarily on their practical skills, chart and

assignment preparation and presentation.

Curriculum Objectives

- To have awareness about the various parameters of measurement such as accuracy, sensitivity, slectivity errors and range of measuring instruments namely analog and digital display types.
- To understand the basic concepts of a galvanometer and that the galvanometer in the basic of most moving coil instruments.
- To explain how galvanometer is used as an ammeter, voltmeter or ohm meter.
- To explain the advantages and applications of multimeter.
- To explain the application of C.R.O for displaying waveforms of elctrical signals. AC and DC voltage measured, AC and DC frequency measurment, Phase difference between to sinusolded signals.
- To narrate the application of CRO.
- To have proper understanding about the basic idea of signal generator and different waveforms that can be generated using it.

Syllabus

Measuring Instruments

Introduction

Introduction- Classification of measuring instruments
definitions of accuracy, sensitivity, errors and range.

Multimeter

Multimeter as volt meter

Multimeter as Ammeter

Multimeter as Ohm meter.

Application, merits and demerits of Multimeter

CRO

Working and block-schematic of CRT

Block diagram and working of a CRO

Application of CRO

Signal generator- introduction only

Introduction to signal generator

3.1.1 Basic concepts of Ammeter, Voltmeter and Ohm meter

Activity.1
Interaction

Lead points for discussion

- How can you know the value of a physical quantity?
- How can you measure the physical quantity?
- What are the measuring instruments you know?
- What more do you know about measurements?
- What do you remember about galvanometer.

The teacher should brushup the previous knowledge through interaction. After discussion, windup the topic giving a clear idea about measurement, measured quantities and measuring instruments.

Consolidation

- Measurement is the process of comparison of a quantity with a standard or reference.
- A measured quantity may either be physical, chemical, physiological, electrical parameters.
- Instruments designed to help measuring these quantities or parameters are called measuring instruments.
- Units of various relevant electrical parameters.

Activity.2
Illustration and group discussion

Illustration

The teacher can perhaps show a figure or a picture or photographs of a of a moving coil meter to help the students recollect what they have already learned. Let the students observe and identify the parts. Let them enumerate the parts as follows:

- Permanent magnet and magnetic poles
- Central iron cylinder with conductor wound in the form of coil.
- Deflecting needle or pointer attached to the coil.
- Presence of the graduated scale.

Group discussion

Elicit response from the students by asking the following questions.

- What do you use to measure current?
- What do you use to measure voltage?
- What do you use to measure resistance?
- Do you remember any thing about these meters?

Bring out their recollections by asking any one from the group to speak out what they have discussed and what they have noted down. The teacher can show an ammeter, voltmeter and galvanometer and ask the students to identify each.

Consolidation

- Moving coil meter is the basic to many meters.
- The parts of a moving coil meter are: Coil of fine wire on an iron cylinder mounted between the poles of a permanent magnet.
- Needle is attached to the coil which moves on a graduated scale.
- Ammeter measures currents.
- Voltmeter measures voltage.
- Ohm meter measures resistance.

3.1.2 General concept of accuracy, sensitivity, selectivity, errors and range

Activity. 3
Interactive session with illustrations and demonstrations.

The students have now got some idea about measurement, measuring instruments and measured quantities. Ask them:

- What do you expect from a measuring instrument?
- Don't you want the reading to be correct and free from the mistakes?

To drive home the concept of measurement parameters like accuracy, sensitivity, selectivity, errors, range etc. real life examples which we see in our daily life may be either demonstrated or illustrated. Given below is a model.

For giving an idea about range, the teacher can demonstrate long scales and short scales. Showing each scale the students can be asked the following questions.

- What is the minimum value, you can measure with the scale?
- What is the maximum value, you can measure with the scale?

The difference between minimum and maximum value constitute the limits of the scale and hence its range. The teacher an correlate the above conclusion to the range of the measuring instrument.

Consolidation

- Accuracy can be said as the closeness of the measured value to the actual value.
- Sensitivity can be defined as the amount of the change in ouput to even the slightest variation in input.
- Selectivity is the ability of the instrument to pickup only the required electrical parameter.
- Range is the measuring limits of the instrument.
- Error is the mistake that occurs during measurement due to faulty instrument

and /or wrong observation like parallax error or calculation.

3.1.3 Classification of measuring instruments.

Activity. 4
Demonstration

Display the different electronic measuring instruments and demonstrate the working of each. The learner should observe and list out the differences.

Consolidation

- Measuring instruments are classified into analog, digital and display type.
- Analog type is usually moving coil type.
- Multimeter can be both analog and digital.
- CRO is a display type instrument.
- Signal generator is a trouble shooting instrument.

3.2 Multimeter

3.2.1 Galvanometer

Activity. 5
Discussion and Illustration

Discussion points

- Parts of a moving coil meter.
- Working of moving coil meter.

Consolidation

- The parts of a moving coil galvanometer are the magnetic poles of a permanent magnet. A coil wound on a frame or cylinder, a needle attached to the coil, recoiling spring to bring the needle back to the position, a graduated scale jewel bearing to reduce friction.
- Initially only the magnetic field due to the permanet magnet exist and the coil does not deflect.
- On passage of current through the coil, it deflect due to the interference of the two magnetic field. ie, The magnetic field setup the current and the field of the permanent magnet.
- Pointers attached to the coil deflect along with the coil.
- The amount of deflection is proportional to the current flowing through the coil.

3.2.2 Galvanometer as voltmeter

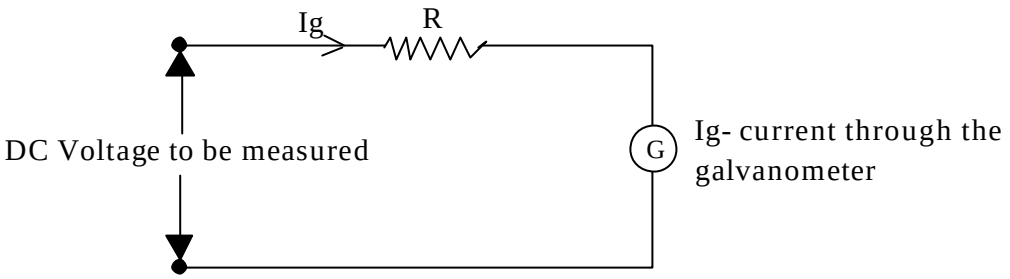
Brush up the previous knowledge about:

- Voltage in a series circuit. Show resistors of different values and volatage drops in each resistors.

- Galvanometer is a very sensitive instrument having a very small internal resistance of about 500ohm and current sensitivity of about 0.1mA.
- Only DC voltage and current can be applied to the galvanometer.
- Voltmeter measures voltage.

Activity. 6
Illustration and Discussion

The teacher can draw the below given circuit and illustrate the conversion of galvanometer in to voltmeter.



Observation

Ask the studens to study the circuit properly. Then discuss.

Points for discussion

- High resistance is connected in series to the galvanometer in the circuit.
- If only a small portion of the applied voltage apprears across the galvanometer, how can it affect the actual voltage?
- Here the teacher can explain how the meter is made to read the applied voltage.

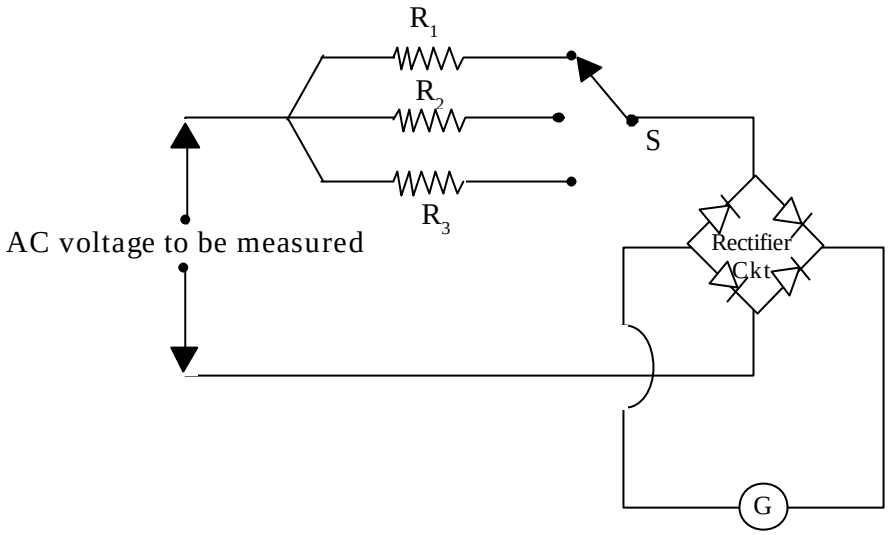
Consolidation

- Galvanometer can be converted into a voltmeter by connecting a high resistance in series to the galvanometer.
- Major portion of the applied voltage drops at high resistance therefore very small amount of current passes through the galvanometer.
- Galvanometer scale is graduated in such a way so as to read the applied voltage.
- Connecting one resistance in series helps to measure voltages in a particular range.
- The range can be increased by connecting different resistors in series as shown in the figure.

Voltmeter for AC voltage measurement

Activity. 7
Illustration and Discussion

The students are aware of the working of bridge rectifier circuit and that only DC volatage applied to the galvanometer. Draw the circuit shown below on the board.



Observation

Ask the students to study the circuit carefully and observe the changes made in the multi range voltmeter circuit, so as to make it suitable for AC voltage measurment.

- What do they find in the circuit and why?

Discuss and bring a conclusion, the working of voltmeter for AC voltage measurement.

Consolidation

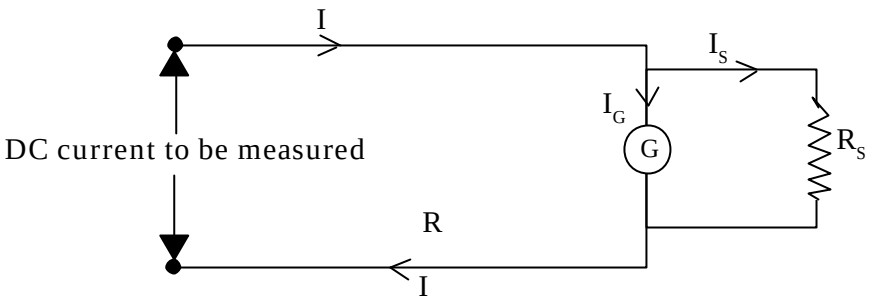
- A simple voltmeter can be used to measure AC voltages by connecting a bridge rectifier in series with a galvanometer.
- Voltmeter should always be connected parallel to the load.

3.2.3 Galvanometer as Ammeter

The students already know that current will be different through each resistor when connected in parallel, necessary details of galvanometer and that ammeter measures current.

Activity. 8
Illustration and Discussion

The teacher can draw the below given circuit of a simple ammeter on the board.



Observation

Ask the students to study the circuit properly and discuss on it.

Points for discussion

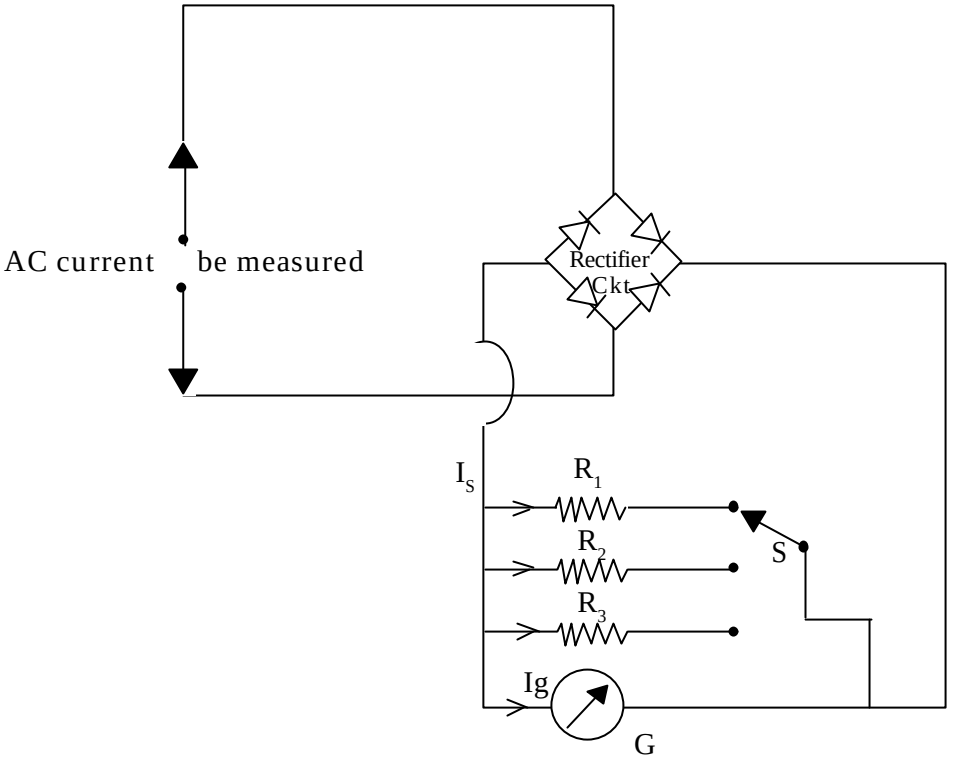
- Compare the Current flow through the shunt resistance(R_S) and the galvanometer.
- When a small portion of the applied current appears across the galvanometer, how will it read the actual current flowing through the circuit.

Consolidation

- Galvanometer can be converted in to an ammeter by connecting a very low resistance in parallel with it.
- On application of current, the major portion of the applied current passes through low resistance (shunt), thus allowing only a small amount of current to pass through the galvanometer.
- Galvanometer scale is graduated in such a way so as to read the applied current.
- Connecting a single resistance in parallel, helps to measure the current in a particular range.
- DC ammeter for measuring various ranges are available.
- Multi range ammeter can be realised by connecting a number of low resistance in parallel with the galvanometer as shown in the figure.
- Each resistance corresponds to one particular range of current. It can be selected by means of a switch.

Activity: 9
Illustration and Discussion

The students already knew the working of bridge rectifier circuit and that only DC voltage can be applied to the galvanometer. Draw the circuit shown below on the board.



Observation

- Ask the students to observe the circuit carefully and observe the changes made in the diagram.
- What is added on the circuit and why?
- Discuss and bring to a conclusion the working of ammeter for AC measurement.

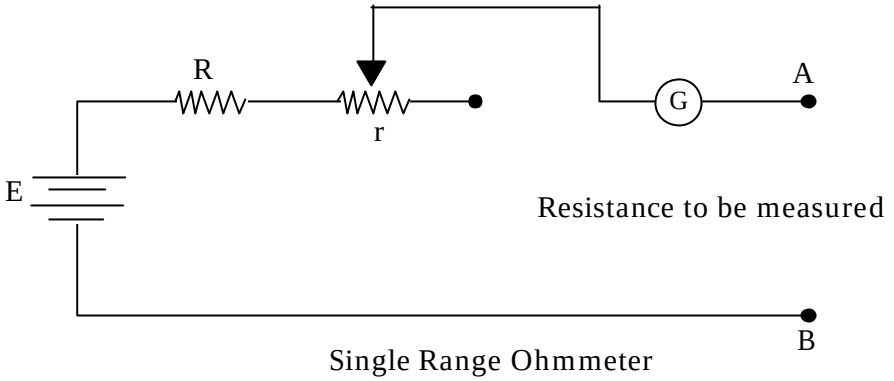
Consolidation

- By including a full wave rectifier in the ammeter circuit, it can be made suitable for reading AC currents.
- Ammeter should always be connected in series in a circuit.

3.2.4 Galvanometer as Ohmmeter

Activity. 10
Ilustration and Group discussion

The students have already learned that an Ohm meter measures resistance. A galvanometer can be converted to an Ohmmeter by connecting a variable resistor and a fixed resistor in series with it as shown below.



Single Range Ohmmeter

Observation

Let the students observe carefully and then carry out a group discussion on the circuit.

Group discussion

The teacher can initiate the discussion by asking the following questions.

- Assume the circuit closed at terminal AB with fixed resistor 'R'. As per ohms law a fixed current will flow through it.
- What will happen when the resistor 'r' is introduced in the circuit?
- Observe that the total resistance of the circuit has increased from R to R + r.
- Note the change in resistance that affects the current in the circuit.
- By adjusting the resistance 'r' can you make galvanometer deflection to zero?
- Suppose after this adjustment you connect a resistance to be measured between terminals AB.
- Now what is the change in resistance?
- Will the galvanometer show a deflection?

The teacher can sum up the points of discussion to explain the working of galvanometer as ohm meter.

Consolidation

- Galvanometer can be converted into an Ohmmeter by connecting a variable resistance and fixed resistance in series to the galvanometer.
- Variable resistance is for zero adjustment.
- Flow of current through the galvanometer is proportional to the total resistance of the circuit.
- Hence the change in resistance cause deflection in the galvanometric reading.
- Connecting one fixed resistance in series to the rheostat helps to measure the value of one resistor.
- The range of the ohm meter can be increased by connecting a number of resistance R_1, R_2,R_3 ...in series to the rheostat.

- The teacher should present multimeter as a combination of ammeter, voltmeter and ohm meter.

3.2.5 Applications of multimeter

The Teacher should demonstrate the applications of multimeter.

1. For checking the circuit continuity.
2. For measuring both AC and DC current.
3. For measuring AC and DC voltages.
4. For measuring resistances.
5. For checking various electronic components like diode, transistor, FET, SCR, etc.

3.2.6 Merits and Demerits of Multimeter

Activity. 11
Illustration by teacher

Teacher illustrates the Merits and Demerits of multimeter

3.3 CRO (Cathode Ray Oscilloscope)

Activity. 12
Illustration and Description

Let the teacher give the block diagram of CRO and explain its various blocks as shown below.

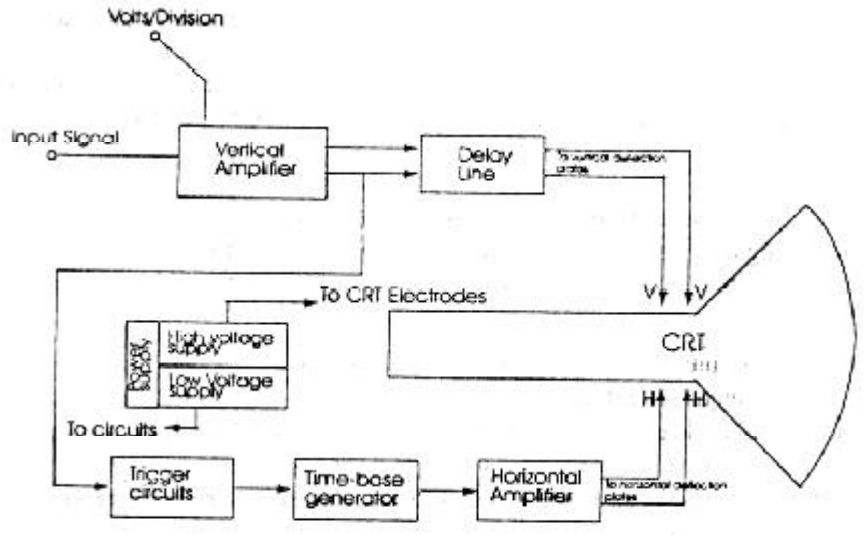


Fig.4(7) CRO-Block Diagram

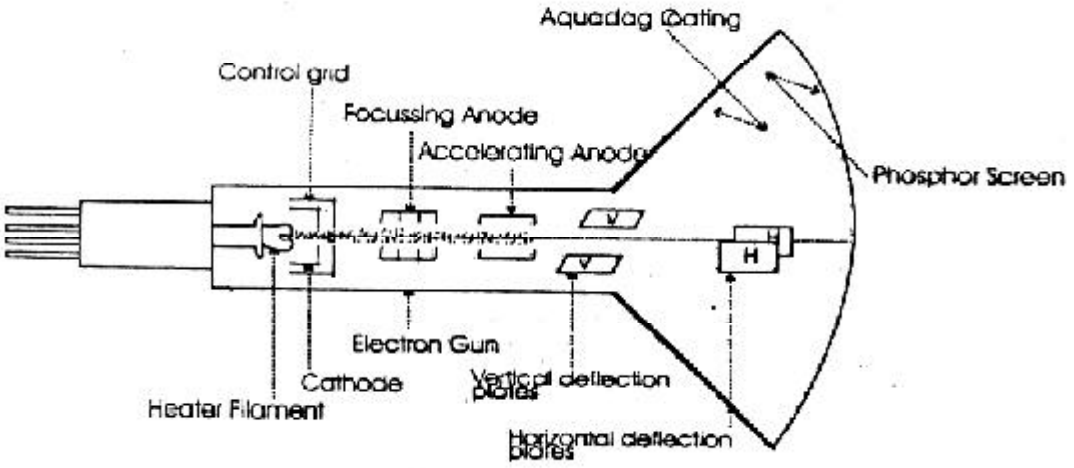
Consolidation

- CRO is an electronic device used to produce visual display of electrical signals.
- Important parts are CRT, Vertical amplifier, sweep generator (time based), trigger circuit, horizontal amplifier, high / low voltge supply, screen etc.
- Explain these important parts.

3.3.1 Working of CRT and brief description

Activity. 13
Illustration and Description using chart

The teacher should facilitate to understand various parts and working of CRT with the help of the figure.



Consolidation

The major parts of CRT are electron gun assembly, deflection system, screen and evacuated envelope.

Explanation of the parts.

3.3.2 Front panel controls of CRO

Activity. 14
Demonstration

The teacher can demonstrate the working of CRO and the use of control knobs on the front pannel of the CRO.

Consolidation

Front panel controls of CRO are intensity control, focus control, horizontal position control and vertical postition control.

3.3.3 Applications of CRO

Activity. 15
Group discussion

Familiarise the students with application of CRO through group discussion.

Consolidation

- Voltage, current and frequency measurement.
- Measurement of phase difference.
- Wave form analysis.

3.4 Signal Generator

Activity. 16
Demonstration and Discussion

Give and Introduction to signal generator and then demonstrate its working, just mentioning various control knobs.

Consolidation

- Signal generator produces alternating voltages of different waveforms of desired amplitude and frequency.
- Waveforms produced are sine, square, triangular, sawtooth and narrow spikes.
- Useful in testing, calibrating and trouble shooting.
- It is a combination of oscillator and waveshaping circuitry.
- Requirements of signal generator.

Other suggested activities

1. Chart preparation

Students can be prepare charts on the circuit diagrams / block diagrams / schematic diagrams as given below.

2. Assignments

Assignments can be given on a major topic.

3. Seminar

The students can prepare a seminar on measuring instruments under the following headings.

- Different classifications.
- Other display meters.

4. CD shows on the relevant topics.
5. Library reference.
6. Visiting educational websites related to electronics or measuring instruments (This will help the students to keep in pace with the advancements made in measuring and measuring instruments.

Subject : Maintenance and Operation of Biomedical Equipment

Unit. 3 : Measuring Instruments

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
1.	To understand the operation and working of measuring instruments.	Measurement and testing of various parameters using different types of Instruments. • Sensitivity • Accuracy. • Errors. • Range	Measuring various parameters. Accuracy in measuring. Observation. Obtaining results.	Experiment. Assign-ments.	CRO. Multimeter. Voltmeter. Ammeter. Signal generator. Various components.	Accuracy. Observa-tion. P.E Report	16	85

4 ELECTRONIC CIRCUITS

Introduction

In the daily life electronic circuit plays a key role. The developments in the field of electronic circuits have constituted one of the great success story of 20th century. In this circumstances our student should have basic idea about electronic circuits and its applications. Especially instrumentation in medical field.

In this chapter we are going to find out application of electronic components both active and passive in various circuits such as Rectifier, Amplifiers, Power supplies, Oscillators etc.

We need electrical energy at low cost. But various power supplies need more size and cost of production. It blocks the compact nature and economic status of the equipment. Thus we are changing AC to DC by using rectifier and filter circuits.

In instrumentation field the measured quantities are very weak in strength. In order to solve this we are utilising the properties of transistor as an amplifier. In order to produce impulses we need bigger signals. Hence we utilise the proper oscillator circuits. This topic gives our students a concrete idea about the application of basic electronic components in circuits.

Curriculum Objectives

- To develop a concrete idea about the various applications of electronic components both passive and active in circuits like rectifier, amplifier filter, and oscillator.
- To make sure that the student is aware of the need of electronic circuits.
- To familiarise the fabrication and operation of rectifiers- circuits and filters.
- To compare the operation and fabrication technique of different rectifier.
- To know the effect of filter circuits in rectification purposes especially capacitor filters.
- To compare the properties like ripple factor, efficiency etc.
- To have the concept of amplification.
- To familiarise the application of transistor as amplifier.
- To familiarise the operation of amplifiers through discussion.

- To understand the classification of Amplifiers basically.
- To understand the basic working principle of CE Amplifier.
- To understand the concept of gain, frequency response and bandwidth of amplifiers.
- To realise the need of amplifier cascading such as direct, transformer and RC coupling.
- To get the basic knowledge about power amplifiers such as class A, class B and class C.
- To know the application of zener diode as voltage regulator.
- To compare +ve and -ve feedbacks.
- To find out application of feed backs.
- To realise the need of feedback in electronic circuts.
- To understand the principle of oscillation and concepts.
- To compare damped and undamped oscillations.
- To develop idea about tank circuits in oscillations.
- To familiarise Colpitt's and Hartley oscillators using diagrams.
- To familiarise crystal oscillators using diagrams.

Syllabus

Rectifiers- half wave, full wave and bridge rectifiers

Define rectifier and explain its type.

Circuit details and operation of half wave rectifier

Circuit details and operation of full wave rectifier

Circuit details and operation of bridge rectifier

Filter Circuits

Definition of filter circuits

Working of C, L, LC and Pi filters

Power supply regulator - Zener Regulator

Zener diode as a voltage regulator

Transistors Amplifier

Single and multistage amplifiers- advantages

Definition and explanation of gain, frequency response and band width.

Classification of amplifiers

Classification of amplifiers according to use, frequency capabilities coupling methods and mode of operations.

Detailed study of R-C coupled, transformer coupled, direct coupled, class A, class B, class C amplifiers.

Circuit and operation of RC coupled amplifier

Circuit and operation of transformer coupled amplifier

Circuit and operation of direct coupled amplifier

Circuit and operation of class A, Class B and Class C amplifier

Feed back

Definition and explanation of positive and negative feedback

Oscillators - Hartley Oscillator, Colpitt's Oscillator and Crystal Oscillator

Definition of damped and undamped oscillation

Working of tank circuits

Circuits and operation of Hartley, collpitts and crystal oscillator

Activity. 1
Brain Storming

- Recollect the previously acquired knowledge about devices and measuring instruments.

Consolidation

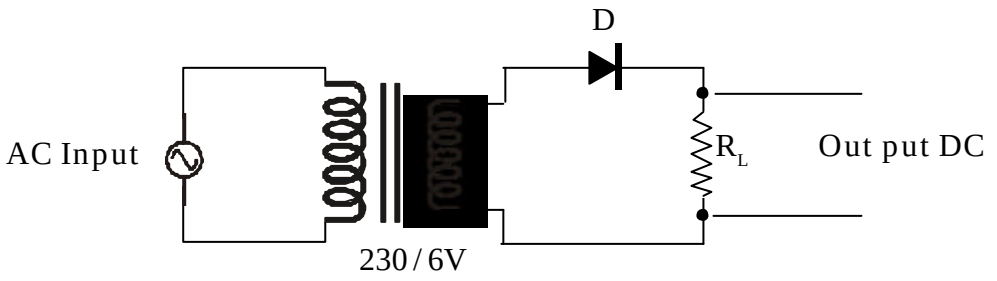
- Concepts of DC and AC fundementals.
- Concepts and uses of resistors, capacitors and inductors.
- Working of transformers.
- Idea about the working of diodes, zener diodes (emphasis on properties) and transistors.
- Basic idea about the measuring procedure using multimeter and C.R.O.

4.1 Rectifiers

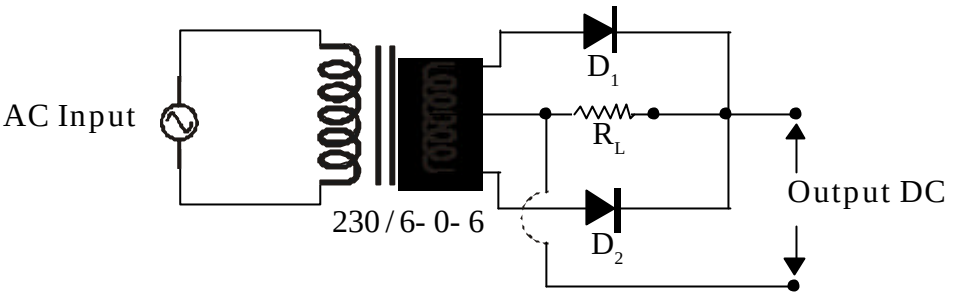
Activity. 2
Illustration (by teacher)

- Define a rectifier
- Mention the need of a rectifier.
- Types of rectifiers- half wave and full wave rectifier, circuit diagram, operation and waveforms of all rectifiers.
- Mention the output waveforms of the above rectifiers and note the differences.

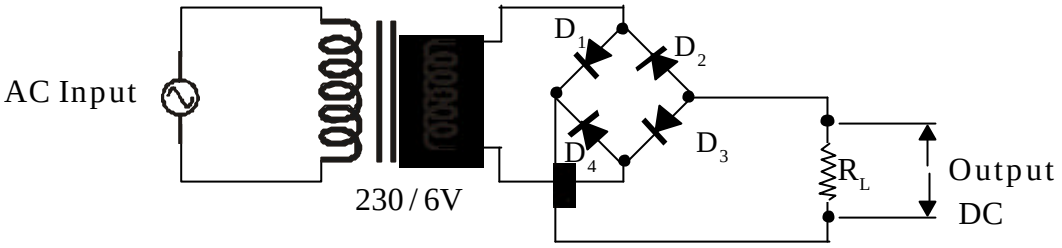
Half Wave



Centre Tapped Fullwave Rectifier



Full Wave Bridge Rectifier



- Explain the operation and working of all the above rectifiers.
- Mention ripple factor, efficiency etc.
- Mention applications.

Activity. 3
Group Discussion

- Rectifier
- Comparison of rectifiers based on circuit details.
- Ripple factor.
- Efficiency.
- Waveform details.
- CD show and internet.

Consolidation

- Rectifier is an electronic circuit used to convert AC to DC.
- Details of half wave rectifier
- Details of centre- tapped fullwave rectifier.
- Details of bridge rectifier.
- Ripple factor of halfwave rectifier is 1.12
- Ripple factor of full wave rectifier is 0.48
- Efficiencyof half wave rectifier is 40.6 percentage.
- Efficiency of full wave rectifier is 81.2 percentage.
- Input and output waveforms of all rectifiers should be noted.

Activity. 4
Experiment

Practical experiments should be done for halfwave rectifier, fullwave rectify centre-tapped rectifier and bridge rectifier.

Various stages of Experminent

Planning

- Selection of practical work.
- Collect required componets and apparatus such as diodes, resistors, transformer connecting wires, power supply, multimeter, CRO, project borad / printed circuit boards, soldering iron and accessories.

Execution

- Check the components using multimeter.
- Allow the learner to fabricate the selected circuit based on its circuit diagram.
- Connet the input and output terminals of the circuit to CRO
- Make arrangements in CRO.
- Observe and plot the waveforms.

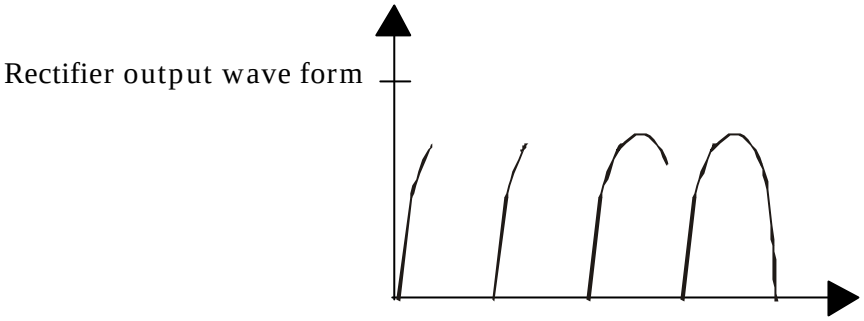
Consolidation

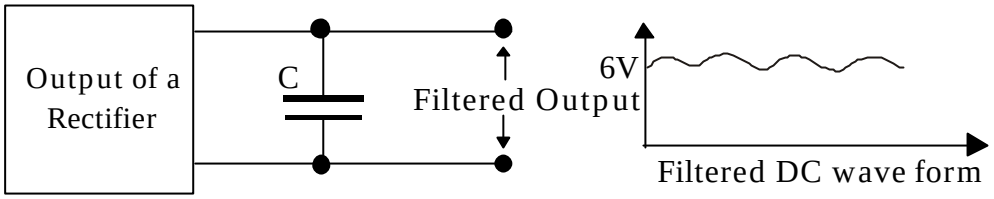
- Checking and connecting components
- Handling and precaution of equipments
- Circuit diagram and working of halfwave, centre-tapped and bridge rectifiers
- Observing waveforms of AC and pulsating DC
- Preparing observation and plotting input and output waveforms
- Preparation and submission of practical records

4.2 Filter Circuits

Activity. 1
Illustration with Demo

- Nature of rectified output
- A filter.
- Need of a filter.
- Working of filter circuit by demonstration.
- Circuit of filters with basic idea of working.
- Working of capacitor filter (Explanation depanding on $X_C = \frac{1}{2p\ fc}$)
- Rectifier ciruit with capacitor filter.
- CD show, Internet.





Consolidation

Allow the learners to prepare notes on;

- Definition and use of filters.
- Basic idea of working.
- Types of filters.
- Circuit diagram of C, L, LC and Pi filter.
- Explanation about working of above filter circuits with emphasis on equation for reactance of C, L.

Chart preparation

- Diagrams of different Recitifiers with filter.
- Exhibit the chart in the class room and allow the learners to observe and prepare necessary data.

Seminar

- Seminar is given based on anyone of all the above topics.
- Seminar should be prepared and presented in the class by the learner.
- Submit the report for evaluation by the facilitator.

Assignment

- Assignment is given based on any topics mentioned above to individuals or groups.
- Prepare them and submit for evaluation.

4.3 Power Supply Regulator

Activity. 1
Demonstration

- Setup a Zener voltage Regulator.

Materials Required

Resistors, multimeter, connecting wires.

Consolidation

- Allow the learner to collect the concept of voltage regulator.
- Need of voltage regulator.
- Circuit and basic idea of working.
- Use of zener diode as voltage regulator.

4.4 Transistor Amplifier

Activity. 1
Illustration

- Concept of amplification.
- Transistor as an amplifier with circuit diagram.
- Concept of gain frequency response and bandwidth.
- Concept of amplifier cascading.

4.5 Classification of amplifiers

Illustration

- Classification based on use, frequency capabilities.
- Coupling methods and mode of operation with details.

Consolidation

Allow the learners to collect idea about;

- Amplifier
- Gain, frequency response, bandwidth.
- Concept of AF, RF amplifiers.
- Circuit of CE amplifier and concept of working.

4.6 Amplifiers

Activity. 1
Interactive Discussion

- Types of amplifier based on coupling method.
- Basic power amplifiers.
- Differentiate between power amplifiers.
- CD shows and internet

Consolidation

- Concept of coupling.
- Basic circuit diagram of two stage RC coupled, transformer coupled and direct coupled amplifiers.

- ClassA, classB and classC amplifiers (basic concept, definition and difference in the mode of operation)
- Circuit of classA power amplifier with idea about basic circuit operation.

4.7 Feed Back

Acvtivity
Illustration

- Concept of feedback system.
- Definition of positive and negative feedback.
- Uses of positive and negative feedback.
- Simple block diagram of feedback system.

4.8 Oscillator

Illustration and Discussion

- Concept of oscillator.
- Damped and undamped oscillators.
- Block diagram of oscillator.
- Conditions of oscillation.
- Working of tank circuits with simple circuit (basic concepts only)

Activity
Discussion

- Different types of oscillator circuits.
- Conditions for oscillation.
- Working and basic circuit of oscillator.
- Comparison of oscillator circuits.
- CD shows and internet.

Consolidation

- Conditions
- Positive feedback for oscillation.
- Overall phaseshift should be zero.
- Loop gain is equal to one ($A\beta = 1$)
- L.C oscillator
- RC oscillator
- Circuit diagram and operation of Colpitt's oscillator Hartley oscillator and crystal oscillator.
- Mention low frequency and high frequency oscillators.
- Mention stability of oscillator.

Subject : Maintenance and Operation of Biomedical Equipment

Unit. 4 : Electronic Circuits

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
1.	Familiarisation of different electronic circuits like Rectifiers, Filters, Zener regulators and amplifiers.	Circuit operation. Application.	Soldering practice. Mounting of components with respect to circuit. Observation.	Identification of components. Fabrication of circuits. Observation. Inference. Interpretation. Chart. Seminar.	Components P.C.B Bredboard Soldering material. CRO.	P.E Report. OT. Presentation.	34	110
2.	Classification of amplifier. Different types of amplifiers.	List out different types.	Identification of different classes. Comparison.	Chart preparation. Collection of different types of simple amlifiers. Group discussion	Library books. Reference books.	OT CT		

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
3.	Acquiantance with feedback circuit.	Different types and applications.	Comparison.	Group discussion. Chart preparation.	Library books. Reference books.	OT CT		

5 BIOMEDICAL INSTRUMENTATION

Introduction

Biomedical instrumentation field is dynamic and there has been tremendous increase in the use of electronic instruments for clinical and research areas of medical education. This branch is developing very fast and experts are engaged in a wide spectrum of activities using most modern biomedical instruments for research and health care. Hence the need for instrumentation is to make proper and accurate measurements.

According to MOBE syllabus, it is difficult to get proper publication which describes the physiological basis as well as the engeneering principles which describe the working of a wide variety of medical instruments. Hence an effort is made to help our facilitators to transact the curriculum effectively.

This unit helps the students to get an idea about basic anatomy of human body. The aim of the unit is to enable the student to understand the basis of cell, tissue, organ, systems of body, resting membrane potential, action potential, biological transucers, biological amplifiers and biomedical recording system. The properties and uses of radiations and radio isotopes are also discussed here. This unit also gives elementary knowledge about organisations of various department in a speciality hospital.

Curriculum Objectives

- To recollect the basic idea about cells and tissues, different organ systems of human body.
- To get knowledge about bioelectric potentials, electrical activity of a typical cell and cell potential waveform.
- To create awareness about biological transducers- different types.
- To develop idea about strain guage, LVDT, capacitance manometer temperature, potentiometric and light transducers.
- To create idea about basic medical recording system- detailing each components.
- To create basic knowledge about differential and chopper amplifiers.
- To get an idea about different characteristics of biological amplifiers.

- To acquire knowledge about various properties and uses of radio isotopes used in medical field.
- To acquire knowledge about different properties and uses of radiations used in medical field.
- To create awareness about various departments in hospital enviornment.
- Introduction to anatomy of human body.
- Cell, tissues, organs and various systems of human body.
- Different anotomical positions.
- Bio electric potentials.
- Ionic distribution in between membranes.
- Resting membrane potential, depolarisation, action potential, repolarisation.
- Typical cell potential waveform.
- Transducers used in medical field.
- Different types of transducers according to applications, method of energy conversion, working etc.
- Elementary knowledge of strain guage, LVDT, capacitance, manometer, temperature transudcers, potentiometric transducers and light transducer.
- Components of a basic biomedical recording system with block diagram.
- Biological amplifiers- basic knowledge about differential and chopper amplifiers.
- Radio isotopes and radiations used in medical field.
- Properties and uses of radio isotopes used in medical field.
- Properties and uses of radiations used in medical field.
- To give introduction to hospital organisation.
- To create elementary knowledge about various departments in a hospital enviornment.

Introduction to Anatomy of human body

Activities

1. Collection of Previous knowledge

Question Answer Session

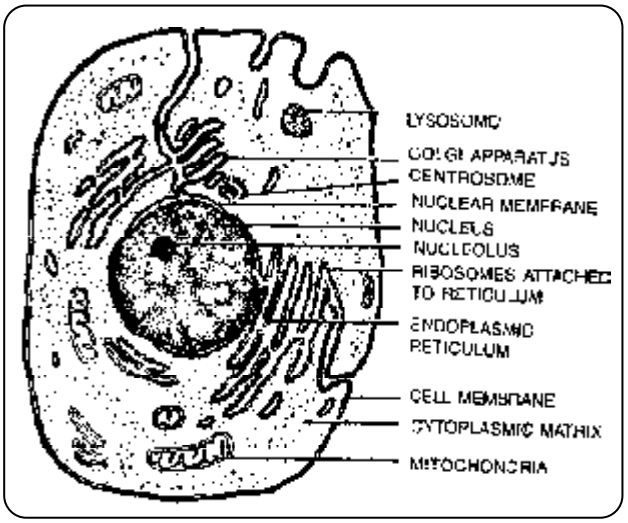
- What is Cell
- What happens when cells are aggregated together?
- What are groups of similar types of cells called?
- What are the functions of a cell.
- What are tissues?
- What are organs.
- What are different organ systems of human body?

2. Group discussion

The group discussion after observation of a chart showing different types of cell and tissues display of CD's or slide show can be made.

Discussion points

- Uni cellular and Multicellular
- Shape of cells related to human body
- Structure of a cell
- Parts of a cell
- Functions of cell organelles
- Comparison of cells and tissues
- Naming of different tissues
- Functions of tissues



An animal Cell

Consolidation

- The cell is the fundamental structural and functional unit of life capable of independent existence and self multiplication.
- Cells are very small and are seen only through a microscope.
- Human cells may vary from one micron to hundred microns in diameter from 1mm to 1m in length.
- Smallest cell is red blood cells.
- Human cells can be circular, biconcave, amoeboid, long, oval, column like, cuboidal, polygonal etc.
- A cell has 3 important parts, cell membrane, cytoplasm and nucleus.
- Each cell is surrounded by a cell membrane or plasma membrane. Cytoplasm is a semi-liquid substance in which cell organelles are embedded. They include endoplasmic reticulm, centrosome, golgibodies, ribosomes, Lysosome, centrioles, mitochondria, etc. Nucleus regulates and co-ordinates various life

processes of the cell. It plays an important role in cell division. It contain factors of heridity (DNA)

- Collection of cells of similar type and function are called tissues. Mainly 4 types of tissues are there, epithelial, muscular, connective and nervous tissues.

3. Charts

- Student can prepare charts and models on cells and tissues.

4. Assignment

After completing the session give the students an assignment which contain structure of cell, different shapes and forms of cells and tissues, diagramatic representation, functions of each organelles and different kinds of tissues.

Anatomy of Human body

Activities

1. Collection of previous knowledge

Collect previous knowledge about different organ systems of human body naming parts, functions and location in body.

2. General discussion

- General discussion using charts, tables or models or CD show in a computer or slide show in OHP or internet.

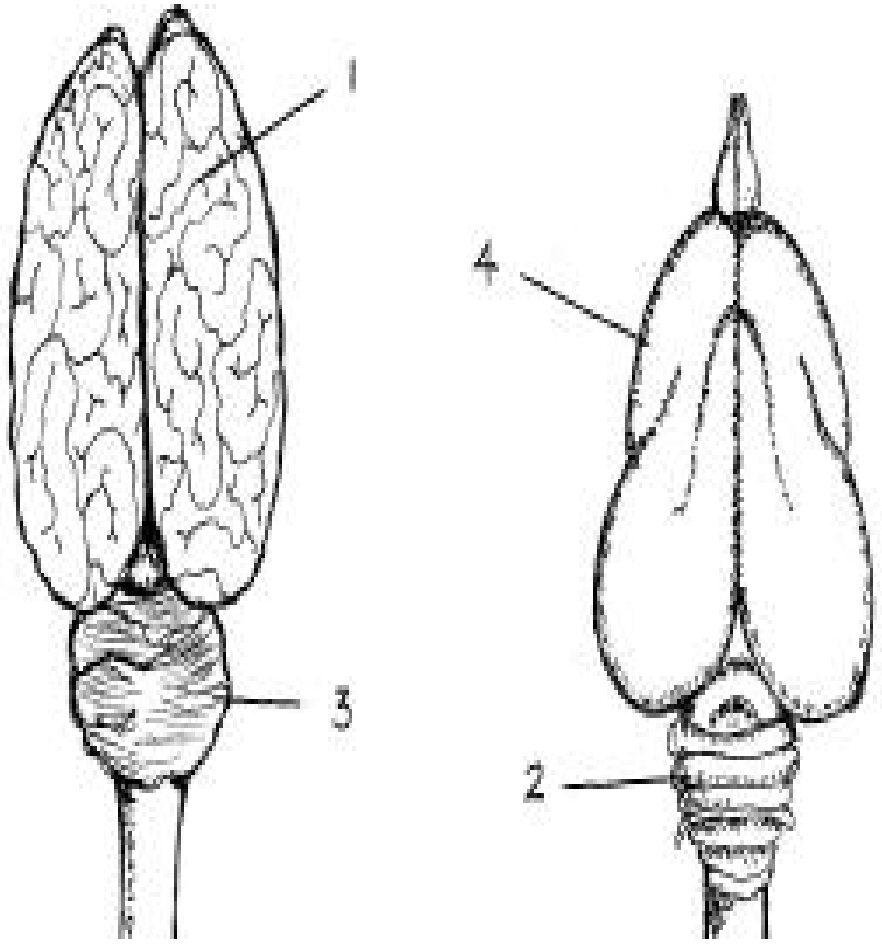
  eg. 1. CD's on human anatomy.
  2. Exploring a cell.
  3. Molecular structure of cell... etc.

- Anatomy of human body.
- Various systems of body.
- Functions of each system.

Consolidation

- Anatomy (ana = apart, tomy = to cut) is the study if the parts and structure of the body as revealed by dissection.
- System is an organisation of varifying numbers and kinds of organs so arranged that together can perform complex functions of the body.
- Ten major systems are Skeletal Muscular, Integumentary, Circulatory, Digestive, Respiritory, Urinary, Nervous, Endocrine and Reproductive)
- Still models of internal organs of body can be prepared.
- Library books for reading.
- Making charts on various systems of body and mentioning its chief functions, finding relationships comparison etc.
- Students can search on internet about more details if they are interested.

- Field visit has to be conducted to medical colleges- anatomy department to see the anatomy museum and dissection laboratory.



Structural Levels of organisaion in the body

Bio -electric Potentials

Activitiy. 1
Group Discussion

Divide students into 2 groups and ask them to identify the +ve and -ve ions present in a cell and outside.

Discussion points

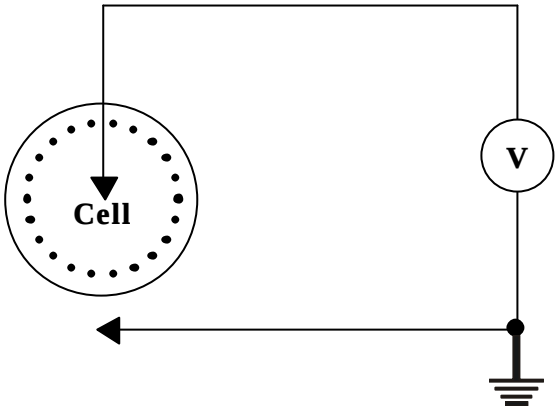
- +ve ions.
- -ve ions.
- Electro- chemical reactions seen in a cell.
- Potential differences generated by the electro-chemical changes accompanied with conduction of signals.
- Potentials during resting state of a cell.

Consolidation

- Concept of +ve and -ve ions present in a cell.
- Bio electric potentials are generated at cellular level.
- In resting state a cell has +ve charge along outside and -ve charge along inside and is said to be polarised.
- This unequal change distribution is responsible for resting membrane potential (approximately -60 - -100 milli volts)

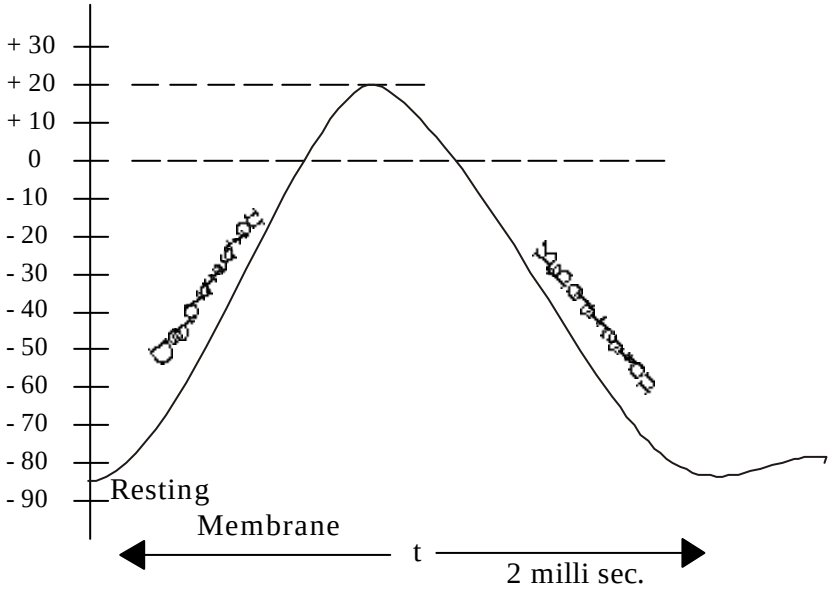
2. Illustration

- Using diagrams / Charts



Points

- How we stimulate a cell
- Depolarisation- resting state to action potential.
- Gaining of action potential (+20mv) depends on the type of cell producing potential amount and types of stimulation.
- Repolarisation
- Plotting of cell potential waveform taking time along X axis (millisec)and Potentials along Y axis (mv).



In nerve and muscle cells repolarization occures so rapidly following depolarisation that the action potential appears as an upward deflection for 1- 2 milliseconds. It is around 100- 300 milliseconds in case of heart muscles as it repolarizes more slowly. Action potential gets propagated in nerves and muscles. Usually the conduction velocity in nerves varies from 20- 140 m / sec propogation through out heart muscle is slower (0.2 - 0.4 m / sec)

3. Demonstration

Demostration can be done to see cell potentials during field visit to Biophysis department in a medical college having an arrangement recording muscle contraction (simple muscle curve) isometric contraction and other waveform) from frog's gastrocnemius muscle.

4. Teacher can give details of CD's and internet which shows details of Bio-electricity. Slide shows can also be arranged with help of OHP.

5. 4 Biological Transducers

Activity

1. An introductory session can be given about the major functions of biomedical instrumentation- to generate interest in the topic and to activate the students to learn about the topic.
2. Biological transduceror electrode is the first part of a medical recording system.
3. Descriptive session by teacher to facilitate learning process.

- Transducer is a device used for the conversion of energy from one form to another.
- Physiological variables like ionic potentials, pressure, temperature, mechanical movements, chemical reactions etc. have to be converted in to some form of display. Transducers can convert one form of variable into electrical signals.
- Active transducers are self generating type.

  eg. Peizo electric transducer
- Passive are externally powered.

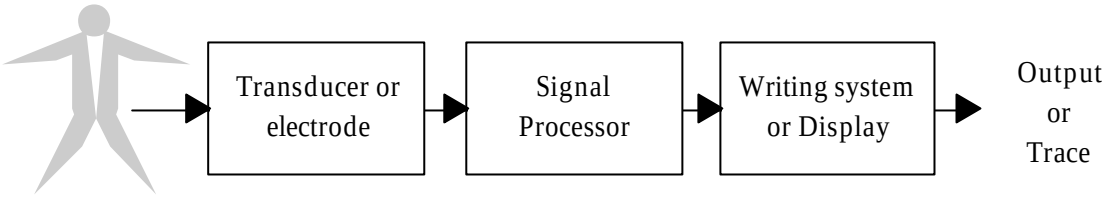
  eg. Capacitive transducer
- The magnitude of variables type of variables, accuracy required, site of application of transducer, period of monitoring, economic status... are the major factors which depend on the selection of a transducer.
- Descriptive details with simple circuit / block diagram of stain guage, LVDT, Capacitance manometer, temperature, potentiometers and light transducers.

Activity. 3

- Drawing of diagramatic representation of the above transducers.
- Chart making.
- Collection of transducers (old or damaged from hospitals or meuseum if possible)

- Comparison of transducers.

5.4 Basic Biomedical recording system



Activity. 1

Drawing of block schematic diagram of basic medical recording system.

Activity. 2

Illustration by teacher about each block.

- Medical Instruments used for measurements / monitoring / diagrams / surgery / therapy can be used in connection with the patient.
- A transducer is the connecting link between patient and signal processor. It transforms the physiological variable into a force that can be read by signal processor.
- Signal conditioner processes the signal- amplifies and modifies into a suitable manner to run the recording or display devices.
- Recorders is the most important last stage which is the writing system.

Bio- electric measurments are low level (mv) measurements involving amplifying and recording of signals. So modern recorders are designed to operate with band widths from DC outputs several hundred cycles per second. Recorders are selected according to the type of chart record and the number of data channels that must be recorded on a single piece of chart paper.

eg. Potentiometer recorder (1Hz- 6Hz)

Direct witing recorder (60Hz- 200Hz)

Ink- jet recorder (Upto 1000Hz)

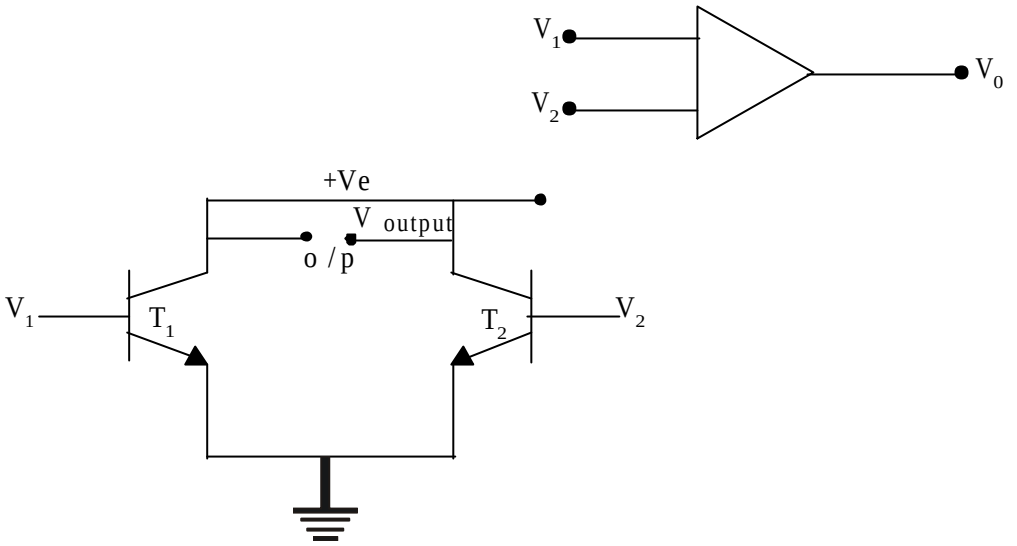
Thermal array UV recorder etc.

Biological Amplifiers

Activity

- As bioelectric potentials are very small signals, it becomes necessary to have a special amplifier with high gain, low noice and better efficiency. An amplifier which satisfies all the above specifications is a biological amplifier. Differential amplifier is one of the biological amplifier which is often used in medical instrumentation.

- A diffential amplifier is a two input voltage amplifier which amplifies the difference in voltage applied at its input terminals.



Differential Amplifier

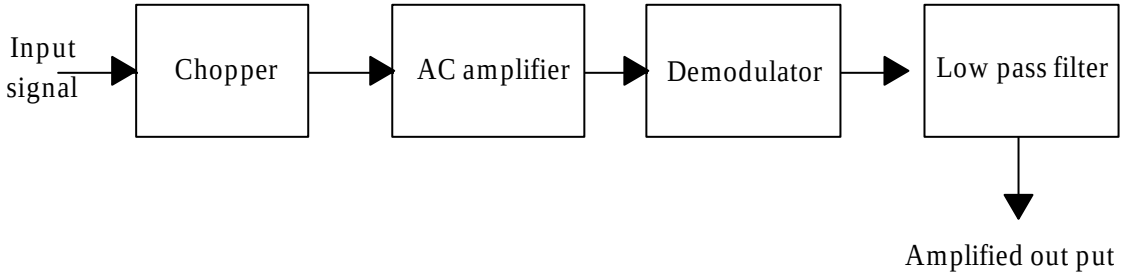
Illustration

- Illustration by teacher based on the above circuit.
- Characteristics of a differential amplifier

1. High gain
2. Low noise
3. Better efficiency
4. Stability
5. CMRR

Chopper Amplifier

- Using the diagram given below the teacher may introduce the concept of chopper amplifier.



Radio isotopes

Activity. 1
Collection of previous knowledge (interactive session)

- What is Radioactivity?
- What are radiations?
- Kinds of radiations.
- Properties of radiations.
- Uses of radiations.
- Radio isotopes with examples
- Properties of radio isotopes.
- Uses of radio isotopes.

Activity. 2
Brainstorming

Points

- Radio activity
- Radiation and its types.
- Uses of radiation and radio Isotopes in medical field.
- Applications in medical field.

Consolidation

- Properties of radio isotopes
- Medical applications of radio isotopes
- Properties of radiations.
- Medical applications of radiations.
- Radio isotopes with examples
- Properties of radio isotopes.
- Uses of radio isotopes.

Activity. 3
Field Visit

- Field visit to Nuclear Medicine department in a Medical College or collaborative institution.
- Preparation of field visit dairy consisting of all the details of visit.

Activity. 4

- CD display
- Internet

Various departments in a Hospital

- Hospitals are organised institutions for better health care of the sick and injured. According to WHO" a hospital is an integral part of a social and medical organisation, the function of which is to provide for the population the complete health care, both curative and preventive and whose out patient services reach out to the family and its home enviorment. The hospital is also a centre for the training of health workers and for bio social research.

The functions of the hospital are;

- Care of the sick and injured.
- Prevention of diseases and promotion of health.
- Diagnosis and treatment of diseases.
- Rehabilation and vocational training.
- Medical education and research.

Organisation

Organisation structure varies from hospital to hospital. But we may see some features common to all.

- The governing body of a hospital usually called the board of trustees or directors is responsible for the policies of the institution.
- The administrator / director is under the govering body, who controls the activities of a hospital.
- The director directs two divisions of the hospital work- the business management and the professional care of the patients.
- The business management includes administration, accounting, maintenance engineering, house keeping and purchasing.
- Under the professional care of the patients are found the medical, nursing, para-medical and other special departments.

Major Departments

- Medical departments- Medicine, surgery, gynecology, obstetrics, peadiatrics, Eye, ENT, dental, orthopeadics, neurology, urology, caridiology, psychiatry, skin, plastic surgery, nuclear medicine etc.
- Nursing departments
- Paramedical departments
  - Pathology department
    i. Bactereology
    ii. Biochemistry
    iii. Haemalogy
    iv. Blood Bank
    v. Histopathology
  - Pharmacy department

- Physical Medicine and Rehabilation
- Radiology department

- Other departments
  i. Bio- medical Engineering department
  ii. Dietary department.
  iii. Laundry department.
- Non professional departments
  - Outpatient and admitting department.
  - Medical records.
  - Personnel department.
  - Administration department.
  - Engineering department.
  - Centrel supply department.
  - Social service.

Subject : Maintenance and Operation of Biomedical Equipment

Unit. 5 : Biomedical Instrumentation

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
1.	To obtain elementary knowledge about cells, tissues, organs and various systems of human body.	Cell. Tissues- types. Organs- examples. Systems- 10 systems of human body.	Identification Differentiation. Awareness. Comparison. Observation.	Discussion. Chart display. Drawing. CD show. Slide show. Internet.	Text books. Library books. Reference books. Slides. CD's. Charts.	CT OT Spotting	35	34
2.	To understand bioelectric potentials.	Concept of bioelectric potentials, its origin and nature.	Awarenss. Inference.	Discussion. Interaction.	Text books. Library books.	OT		
3.	To create a concrete idea about electrical activity of a typical cell.	Electrical activity of a typical cell. Typical cell potential wave form.	Experimention. Observation. Inference. Interpretation.	Ploting of waveform.	Arrangements for recording cell activity. Reference books. Charts. Internet.	OT		

Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
4.	To acquire basic idea about medical recording system.	Components of medical recording system:- transducer signal conditioner display.	Identification. Awareness. Drawing.	Drawing of block dia-gram.	Library book. Chart. Internet.	CT. Viva.		
5.	To develop idea about biological transducers and electrodes.	Concept of transducer. Types of transducer. Working and applications.	Identification. Comparison. Observation. Exhibition.	Discussion. Seminar. Collection.	Library books. Diagrams. Charts. Internet.	CT PE Report Presenta-tion.		
6.	To develop basic knowledge about biological amplifiers.	Differential amplifier. Chopper amplifier.	Identification. Drawing.	Drawing of circuit diagrams. Group discussion.	Library books. Slides. Charts.	CT		

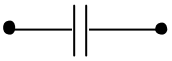
Sl. No	Curriculum Objectives	Concept	Process Skills	Activity	Materials	Evaluation	Total Time	
							Theo.	Pract.
7.	Elementary knowledge about radioisotopes and radiations used in medical field.	Radio activity. Radio isotopes and their medical applications. Radio active and their medical application. Other radiations like X-rays, LASER.	Identification. Logical skill. Comparison. Inference	Discussion. Chart. Assignment.	Text books Library books. Slides. Internet.	CT.		
8.	To acquire elementary knowledge about hospital organisation.	Various departments in a hopsital enviornment.	Awareness Organisational skill. Communication skill. Experimentation.	Field visit. Project. Chart. Simulative experiment.	Reference books. Catalogue Journals. Internet.	Report presenta-tion and evaluation.		

10. SAMPLE QUESTIONS

1. Resistance of a conductor varies

   a. Directly with its length
   b. Inversily as the cross- section of the conductor
   c. Both a and b
   d. None of above

2. Choose the odd one out.

   a. 
   b. 
   c. 
   d. 

3. Choose the odd one out, justify your's answer.

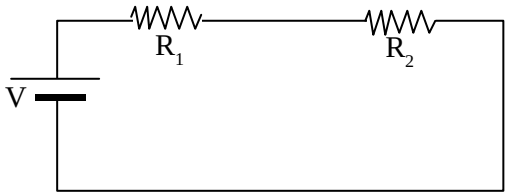
   a. Transistor
   b. SCR
   c. Resistor
   d. FET

4. "The terminal voltage of an ideal voltage source will change according to the load connected in it".

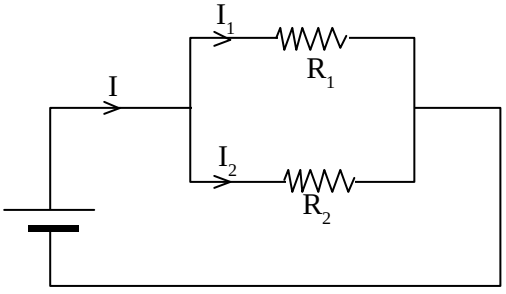
   (True or false)

5. What is the law behid the relationship between voltage, current and resistance?

6. Explain the law behind the relationship voltage, current and resistance.

7. 

   The voltage drop across the resistor R_1 is 2V and that of R_2 is 1V. Findout the soource voltage?

8. 

The current I_1 and 20mA and I_2 is 30mA. What will be the total current I?

9. You are given a resistor having colour codes of Blue, Grey, Orange. Find out its value?

10. An electronic circuit requeres 4.7 KΩ ±5% resistor. Find out its using appropriate colour codes.

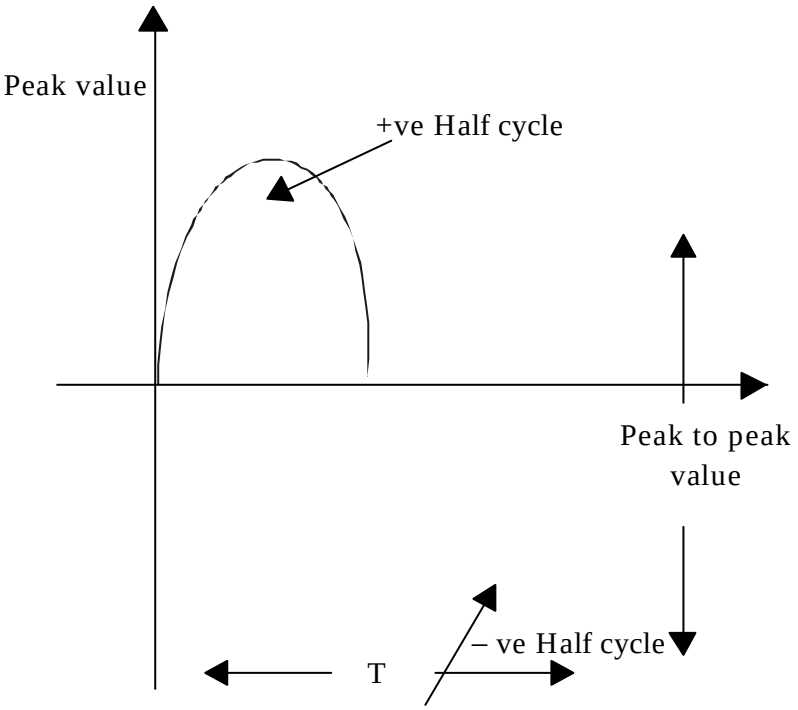
11. Match the following,

Ohm	Current	Self induction
Farad	Indcutance	Dieletric
Henry	Resistance	Ammeter
Ampere	Capacitance	Ohmmeter
Volt	Generator	Voltmeter

12. Statement regarding trnasformers are given below. Classify them as step up and step down.

    a. The number of tuns in the secondary is greater than primary.
    b. The number of tuns in the secondary is less than primary.
    c. The thickness of primary coil is greater.
    d. The thickness of secondary coil is greater.

13.



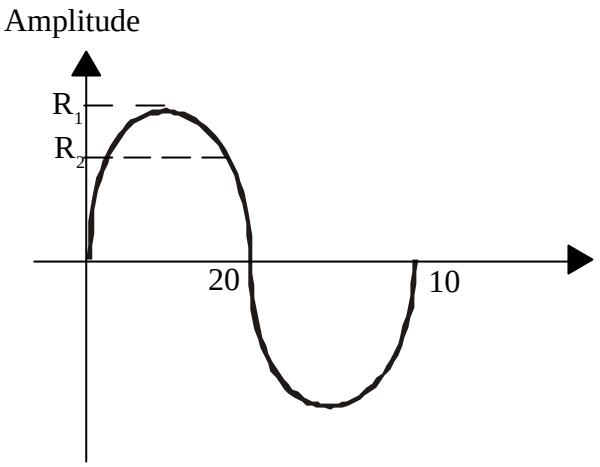
Briefly describe the various parameters shown in the diagram.

14. An AC signal takes 100 msec to complete 10 cycles. Can you predict the frequency of the signal.

15. “We can convert a galvanometer in to ammeter? with a suitable diagram explain the statement?

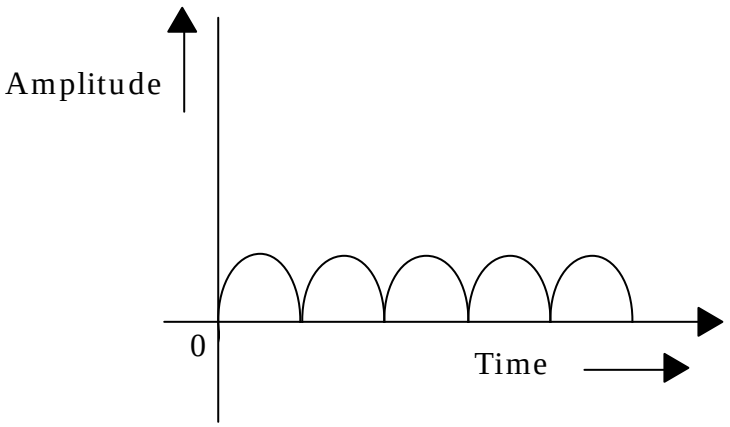
16. You are femiliar with a lot of electronic equipments. List any five of them with their functions.

17. Findout the following from the above AC signal.



    a. Peak value (Amplitude)
    b. Peak to peak value
    c. Time period.
    d. RMS value.
    e. Average Value.

18. You have given a waveform shown below.



    Draw and explain the working of the circuit capable of producing the above waveform.

19. You have given some components both active and passive. Using those components draw the circuit diagram to solve this problem.

21. You are given a multimeter. Mention some applications if it in the electronic lab.

22. "AC cannot be stored"- Give the reason.

23.

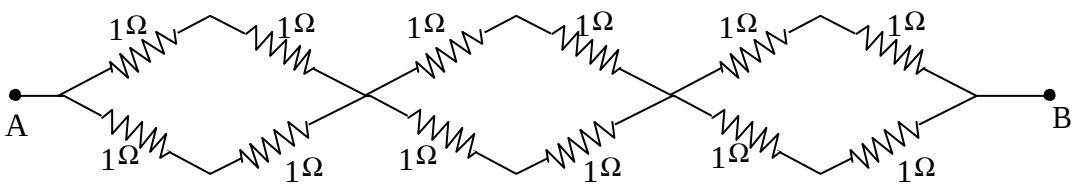
Amplitude (V)	Time (S)
0	0
1	.5
2	1
3	1.5
2	2
1	2.5
0	3
-1	3.5
-2	4
-3	4.5
-2	5
-1	5.5
0	6

Identify whether the colomn represents DC or AC.

24. Match the following.

A	**B**	**C**
Resistor	Dielectric medium	Magnetic field
DiodeWindings	Rhestat	
	Tolerance	Magnetic field
	Deplection layer	Rectifier

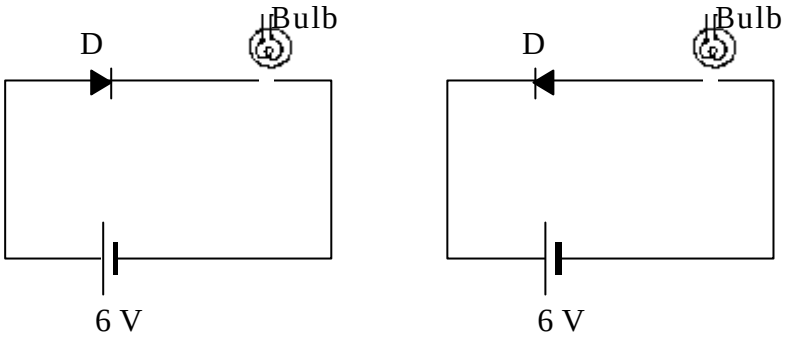
25.



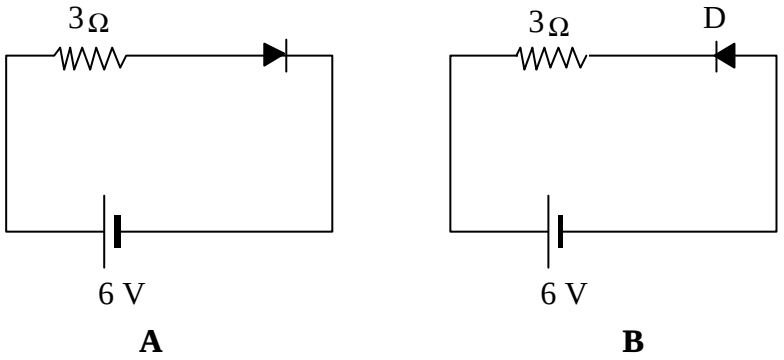
Calculate the equivalent resistance between the points A and B.

26. You are given resistor having colour code of Blue, Grey, Orange. Find out the value of resistor.

27. In the below ciruits whether the bulb will glow or not? Justify your answer.



28. Find out the current through resistors in both the circuits given below. Also find the reason for the difference in currents of both the circuits.



29. State whether the following statements are true / false. If false correct it.

    a. The minority carries in P-type materials are holes.

    b. Zener diode acts as voltage regulator in break down region.

30. Suppose you went an electronicshop ana brought five diodes of 1 Ampere. How will you lest whether they are good or bad?

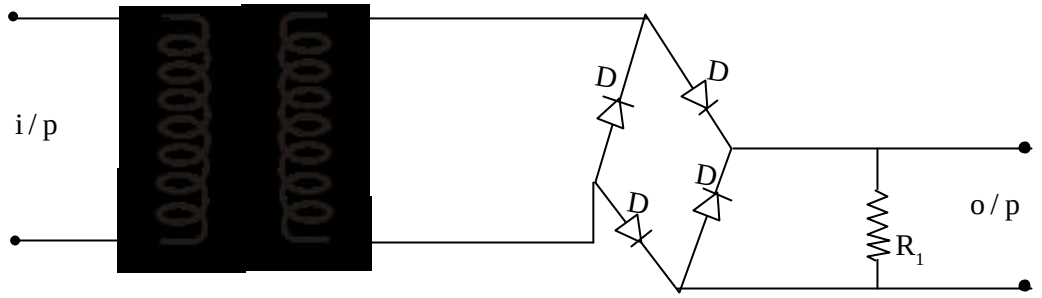
31. You want to set up a rectifier circuit with filter. You are directed to purchase the components for the circuit. Prepare the list of components and their specifications.

32. **You have given the equation R =** ? $^{l}/_{A}$. State the laws behind the equation.

33. You have given two amplifier circuits. Draw a diagram showing any one of the amplifier cascading (matching) methods.

34. Operational Amplifiers are widely used in medical instrumentation. Can you brief out its characteristics.

35.



a. State whether the circuit is correct or not
b. If incorrect draw the correct circuit.
c. Mention the name of the circuit.

36. Suppose two amplifiers having gains '10' and '5' are given to you. Arrange the two amplifiers to get a gain of 50.

37. You have given different sections of an equipment.

1. Grid
2. Anodes
3. Deplection (Horizondal)
4. Cathode
5. Aquadage coating.
6. Deflection (Vertical)
7. Screen

a. Identify the equipment.
b. Arrange the sections with the help of a schematic diagram.

38. You want to convert light energy into electrical energy. What device you prefer. Justify your answer.

39. As you know capacitance $C = \frac{SA}{d}$.

a. Identify the transducer which is utilising the above equation as principle.
b. Describe this transducer with the diagram.

40. "Galvanometer can be converted in to an ammeter". Do you agree with it? If you how it is done?

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Other Suggested Books

1. Basic Radio and T.V - Sharma
2. Basic Electronics - Atext lab mannual
3. Electronic management - A.K Shoney
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