TEACHER TEXT

Higher Secondary Course

ELECTRONICS

CLASS - XII

Government of Kerala

DEPARTMENT OF EDUCATION

State Council of Educational Research and Training (SCERT), Kerala

2015

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Foreword

Dear Teacher,

We have introduced activity based, learner-centred, process oriented pedagogy in Higher Secondary classes as part of the continuation of curriculum revision at school level.

As per the rules of the RTE Act, the idea of learning outcomes was introduced in the Kerala school curriculum 2013. Knowledge of learning outcomes is essential to plan the teaching learning process and assessment in a precise and practical manner.

As you know, the process of transacting the curriculum is challenging as it demands higher level of proficiency and dedication on the part of the teacher who plays a pivotal role.

For effective learning, learning experiences should be based on specific objectives and focussed on learning outcomes. Our teachers are quite resourceful and can easily come up with much more compelling and innovative ideas and strategies than the ones suggested in this book. You are always welcome to do so to make teaching-learning process an enjoyable experience.

The Teacher Text in Electronics for second year Higher Secondary Course offers a few guidelines which aim at familiarising the practising teachers with the changed strategies to be adopted in the classroom.

Suggestions for improvement are most welcome.

With regards,

Director

SCERT, Kerala

About Teacher Text...

The teacher text should be one that helps the teacher in daily planning, provides instructions adequate to carry out the activities in the textbook, persuades the teacher to seek for more information and provides the additional information needed for the teacher. The relevance of the teacher text is that the teacher must be provided with deeper insight of the activities in the textbook, additional activities, samples of assessment and transaction strategies. Hence the following are included in the teacher text.

Preface

A preface is provided for each unit. The main concepts aimed in the lesson, process skills to be developed among students, the values and attitudes to be inculcated and the social significance of the topic are indicated in the preface. The preface is a window to each lesson.

Unit Frame

Each unit frame is prepared in relation to important science concepts. A unit frame has 3 parts. The first part includes details regarding the science concepts that the child should know, the process skills to be developed for achieving the learning outcomes. The second part indicates the learning activities. The last part includes the major learning outcomes that the student must achieve. The approximate time needed for each unit is mentioned. The lesson is divided into three or four modules by grouping learning outcomes and the related science concepts. Prepare lesson plan according to the module.

Towards the Unit

For the effective transaction of the content certain activities are suggested. The teacher can follow those suggested activities or make use of a suitable learner centred, activity based, strategies based on his/her own requirement. Details necessary for carrying out the ICT possibilities are provided in the teacher text.

Assessment

It needs no emphasis to state the importance of assessment for effectively conducting learning activities. Indicators of important activities and products that ought to be subjected to assessment in each module are provided in the teacher text. This does not mean that they are only to be assessed. The teacher has to prepare on his/her own worksheets for continuous assessment-self-assessment and peer assessment tools. Some samples are given in the teacher text.

Contents

Part-A

Part-B

General Approach

Introduction

The National Curriculum Framework 2005 sowed the seeds for many reforms in the field of education in India. Subsequently, NCERT prepared textbooks for various subjects based on NCF 2005. Later the, Kerala Curriculum Framework 2007 was formed and the curriculum upto high school level was revised. The Right to Education Act of 2009, Prof. P.O.J.Labba Committee Report related to Higher Secondary Education and Dr. P.K.Abdul Aziz Committee Report related to a comprehensive curriculum revision - all pointed towards the necessity of curriculum reform.

In the 1990s, a new curriculum with comprehensive changes in learning and pedagogy was introduced at the primary level. Based on this activity-based, process-oriented and learner-centred curriculum, Continuous and Comprehensive Evaluation (CCE) and grading system were implemented. Subsequently, this method was introduced at the Higher Secondary level too.

Significance of Curriculum Revision

Though activity-based pedagogy has already been introduced at the higher secondary level, a comprehensive revision of curriculum has not been implemented yet. The ongoing syllabus revision interacts with contemporary events and takes into consideration the nature of the learner. As a stepping stone to the higher education sector, the higher secondary curriculum should be raised to international

> *The curriculum, syllabus and textbooks being followed for more than five years should be revised and reformed urgently by SCERT.*
>
> ***Prof.P.O.J.Labba Committee***
>
> *As a knowledge society, it is of paramount importance to basically restructure and reform the curriculum to face the challenges posed by the times.*
>
> ***Dr. P.K.Abdul Aziz Committee***

standards. International standards do not refer to the standard of education set by any particular country. On the other hand, it must inculcate in the learner the ability to take his life forward wherever he is, after the completion of his higher secondary education. It is the sum-total of all the experiences and knowledge to be picked up by the learner for meeting the needs. This emphasizes the need to provide internationally accepted teaching-learning models to our students. The curriculum revision has been envisaged as an attempt in that direction.

RIGHT TO EDUCATION ACT - 2009
Section - 29 (Chapter 5)
Curriculum and evaluation procedure

(1) The curriculum and the evaluation procedure for elementary education shall be laid down by an academic authority to be specified by the appropriate Government, by notification.

(2) The academic authority, while laying down the curriculum and the evaluation procedure under sub-section (1), shall take into consideration the following, namely:

(a) conformity with the values enshrined in the Constitution;

(b) all round development of the child;

(c) building up child's knowledge, potentiality and talent;

(d) development of physical and mental abilities to the fullest extent;

(e) learning through activities, discovery and exploration in a child-friendly and child-centred manner;

(f) medium of instruction shall, as far as practicable, be in child's mother tongue;

(g) making the child free of fear, trauma and anxiety and helping the child to express views freely;

(h) comprehensive and continuous evaluation of child's understanding of knowledge and his or her ability to apply the same.

The curriculum should be revised ensuring the above-mentioned factors, and the revision of the curriculum has to be viewed against this backdrop.

Kerala School Curriculum (2013) - Chief characteristics

The curriculum

- is learner-centred, process-oriented, activity- based and value oriented.
- gives stress to the learning outcomes that a learner imbibes at the cognitive, social and emotional levels.
- lays stress on the skills to be attained by the learner in values and attitude.
- is based on the philosophy of constructivism.
- gives teachers freedom to choose and employ logical and varied learning strategies for the transaction of curriculum.
- is flexible to implement various teaching - learning strategies recognizing the learning outcomes, nature of the content and the different levels of the learners. Discovery learning, Concept attainment model, Inductive method, Meta cognition, Co-operative learning, Collaborative learning, Reflective learning, and giving opportunities to individuals and group learning etc. are taken into consideration.
- is comprehensive and takes into consideration the various stages from the pre-primary level to the higher secondary level.
- designs innovative learning strategies as well as assessment activities for children with special educational needs.
- ensures a Continuous and Comprehensive Evaluation (CCE) focused on learning outcomes.
- stresses Health and Physical Education, Art Education and Work Education.
- lays stress on Right-based Education in the light of Right to Education Act, 2009.
- provides an opportunity to the learner to experience necessary safety, care and security both at school and in the classroom by raising the teacher to the level of a mentor.
- lays stress on the Code of Professional Ethics for school teachers.
- helps to acquire new learning skills which enable the learner to face contemporary challenges.

- is intended to inculcate human values in the learners.
- ensures equity and equality among the learners.
- ensures the harmony of head, heart and hand and aims at a comprehensive development envisioned to make learning natural.

Curriculum Approach

Our curriculum has been developed, imbibing new thoughts in educational psychology and philosophy. The idea of constructivism put forth by NCF 2005 is the basis for the Kerala School Curriculum 2013 too. In constructivism, learning is the process of the construction of knowledge.

The striking features of the curriculum transaction approach are:

i. Activity - based

ii. Process- related

iii. Ensure learning

iv. Focus to attain learning outcomes

v. Environment- friendly

vi. Highlights development areas

vii. Suitable for the nature of the learner

viii. Integrates learning and assessment

A learning process based on constructivism is the foundation of the curriculum. A distinguishing feature of this approach is that knowledge is constructed naturally by creating challenging learning activities and considering the acquired knowledge and conceptual background of the learner.

Learning Experiences

The acquired knowledge skills and interests differ from learners coming from different backgrounds. So it is very important to facilitate learning experiences imbibing these changes and considering individual differences and multiple intelligences of the learners.

Learning Environment

The classroom should be designed to keeping in mind the interest and development of the learner so as to ensure his/her participation in various learning activities. Every activity should be learner-oriented. A conducive environment should be created. The freedom to employ suitable learning strategies which are learner-centred and activity-based, taking into consideration the development and growth in the learning ambience rests with the teacher.

Learning Process

- Each learner constructs knowledge by linking it with his/her previous experiences.
- Knowledge construction occurs at the level of the individual through meaningful societal interventions.
- Learning is made effective through multi-sensory experiences which consider various learning styles, learning pace etc.
- Learning becomes more effective through co-operative learning in an environment conducive for co-operation.
- Learning materials should be meaningful generating interest in the learner.
- Spiralling of learning experiences will make learning more effective.
- By ensuring flexibility of learning activities and possibilities of adaptation, learners requiring special educational needs and with different aptitudes may be attended to.
- Each learner should get learning experiences necessary to ensure learning outcomes.
- Learning and Assessment should be complementary.
- Everybody can attain learning outcomes by adopting suitable teaching- learning strategies that consider content and learning requirements of the learner.
- The learning process should be decided keeping in view the comprehensive development of each learner.

Learning Outcomes

As per the rules of the RTE Act, the idea of learning outcomes was introduced in the Kerala School Curriculum 2013. Knowledge of learning outcomes is essential to plan the teaching-learning process and evaluation, in a precise and practical manner. Learning outcomes are the aims to be achieved by the learner during the various stages of school education. Precise and accurate statements based on the knowledge, skills, attitudes, values etc. to be acquired by a learner in a particular subject-area are called Learning Outcomes.

The learning outcomes should be stated based on performance that can be observed and measured. An analysis of the learning outcomes will help assess the knowledge, skills, values and attitudes that should be acquired by the learner at the end of each unit, class and stage have been acquired or not. Precise and clear assessment activities can be planned, based on specific learning outcomes.

Information and Communication Technology

Today information and communication technology has an important role in the construction and dissemination of knowledge. This is made possible through gathering of information, analysis and varied presentations. The immense possibilities of ICT can be used to transact any subject at the higher secondary level. Through this, it can also be ensured that learners acquire ICT skills. The main features of ICT are stated below.

Art Education

Arts evolved as a part of providing enjoyable experiences in the progress of man as a social animal.

The experiences gathered during various phases of life touch human minds aesthetically. All the art forms that evolved from ancient times were visual and auditory. It had the power of rejuvenating the human mind. This is the unique characteristic of art.

Art education at the higher secondary level aims to develop the creative skills acquired by the learner and to create in him a broader outlook about art and literature. Also an aptitude for higher studies and research in the field of arts has to be developed in them. In order to develop observation skill, ability to appreciate and sense of imitation among learners, art education is essential. It also helps learners to develop abilities to think and respond differently, to ensure social intervention and to make learning more productive. Activities in art help to make children work hard and diligently, and also channelize their enthusiasm in the right direction.

Health - Physical Education

The term health refers to the complete state of physical, mental, emotional and spiritual well-being. Therefore health is essential for the existence of an individual. So proper implementation of health and physical education is essential. The minimum physical fitness required for every individual in the society in order to exist should be ensured. For this, health and physical education should be imparted scientifically and comprehensively from a very early age. The views of National Curriculum Framework 2005 regarding need based and integrated approach should be given special attention and emphasis.

Along with the knowledge of content areas, performance excellence and physical fitness are also to be assessed. The health-physical education envisioned in Kerala School Curriculum 2013 and initiated at the primary level, gets perfected at the higher secondary level only. Learning activities should be planned so as to enable learners excel in this field to explore up to the level of international possibilities. The physical fitness, training excellence and knowledge of content areas acquired hitherto promote holistic well-being.

Objectives of Health - Physical Education

- To get an awareness about sports, values and ethics.
- To gain expertise in athletic skills and to scientifically analyse them.
- To gain expertise in major games.
- To get practical training in self defence techniques.
- To understand aggression, balanced or controlled aggression etc.
- To realise the consequences of the use of drugs.

- To create the right understanding about sexual health.
- To acquire scientific practical ability to intervene effectively during life rescue missions.
- To get an awareness about the changes in the respiratory and cardio-vascular system that can be brought through exercise.
- To give training using safe and effective exercise pattern.

Work Education

The confluence of knowledge acquired through hearing, sight and work makes construction of knowledge possible in a learner. Contemporary learning process evolves through enquiry and experiences. Work education is essential to integrate and develop emotional and cognitive domains.

A work education integrated with the subjects of higher secondary curriculum, will be more appropriate.

Objectives of Work Education

- Readiness to work
- Development of values and attitudes
- Development of a balanced personality
- Self-sufficiency in the field of production
- Human skill development
- National development

Inclusive Education

In the classroom, an atmosphere that is congenial to all learners without excluding any one must be created. In our schools there are two categories of students, one who requires more consideration, help and attention and the other who requires normal help and attention. Only by addressing this can we ensure equitable quality education.

Areas which help to develop values, attitudes and commitments

Areas such as awareness of humanitarian and constitutional values, attitudes that strengthen social life and growing social commitment are the prime concerns of the curriculum. Details of the conceptual areas are given below.

Democratic Outlook

While choosing the content for different subjects, the perspectives on democracy have to be considered. In the planning and transaction of learning activities, there should be a democratic approach. The aim of the curriculum is to establish a democratic approach through democratic platforms.

Constitutional Values

The values and objectives that are upheld by our Constitution have to be reflected in the curriculum. The content and the transaction process should be selected to enable learners acquire constitutional values.

Secular Attitude

Subject areas which help in developing a secular attitude have to be included.

Tolerance

The curriculum should aim at developing the quality of tolerance towards those who disagree with you.

Constructive and Creative Thinking

There is a need to develop creative thinking and the urge for discovery among learners. There should be possibilities for creative enquiry in the content areas and learning strategies of the curriculum. The different levels of multiple intelligences should also be considered.

Respect for one's cultural heritage

Respectful attitude to one's cultural heritage and history is one of the aims envisioned by the curriculum.

Equality

It is essential to ensure equality in learning activities, which are provided to the learners.

Leadership Quality

There is need to design learning strategies that would help in shaping leaders who are capable of facing the challenges of this millennium. In the classroom, opportunities must be created to develop leadership qualities among children.

Life Skill Education

Life skills such as self awareness, empathy, communication skill, interpersonal relationship, creative thinking, critical thinking, decision-making, problem-solving, coping with emotions and coping with stress should be developed in learners. These life skills help the learner to face life with self-confidence.

Civic Sense

Just as the state has certain duties to the citizens, the citizens also have some duties to the state. The aim of education is to create a community with civic sense and a sense of responsibility and discipline.

Respect for Elders

Respect for elders is the keystone of our civilization. In all cultures, old people are venerated and given due consideration. An important characteristic of the elder people is that they are a store house of experiences. Our cultural life being continuous and heritage-oriented, the age-old experiences and knowledge are handed down from one generation to another. Factors which encourage learners to express respect for elders through co-operative interventions should be made part of the transaction of content.

Human Rights

Human rights are the rights of individuals to lead a life of dignity. The human rights which got universal acceptance through the United Nations Declaration of Human Rights should be given importance in the curriculum.

Child Rights

It is our duty to protect every right of the child.

Awareness about Environment

Basic awareness about nature and the need to protect natural resources should be included from the primary level itself. Children should be made to understand that environmental hygiene is as important as personal hygiene and that sense of hygiene is one of the basic factors of civic sense. They should understand that nature and natural resources are not meant just for the consumption of human beings and that any change in the balance of nature will have far- reaching consequences. They should carry out activities which make protection of natural resources and environmental hygiene a value-system and an attitude.

Water Literacy

Children must be made to understand that water is precious by creating awareness about the availability of water, conservation of water and the need to keep it free from pollution.

Peace Education

The basic idea of peace education is to develop values and attitudes to interact with others and the surroundings in a peaceful and friendly manner. It is essential to include content areas that reflect values like avoiding conflicts and situations leading to conflicts, peace and harmony.

Legal Literacy

Knowledge and awareness about law is essential for all citizens of a democratic country. It is the need of the hour to include content areas that ensure legal literacy. Various programmes involving Law Clubs, Law Clinics etc. can be organized to create awareness of law.

Cyber Literacy

The misuse of ICT and related crimes are on the rise. Awareness should be created among children on these activities. They should be given a clear idea about the proper use of Internet, e-mail and social networking sites. The curriculum should facilitate creating awareness among children regarding the punishment for cyber crimes and the ethics in the use of internet etc.

Media Literacy

Media exerts a great influence on our society. It is impossible even to imagine a day without visual media. Visual media has tremendous influence on children. Therefore, the content area of the curriculum should contain various factors required to create critical media literacy.

Perspective on Sustainable Development

The curriculum should spread the awareness that this earth exists not just for the benefit of mankind. An understanding regarding the environmental challenges, human interventions which cause harm to environment, and how nature can be protected from such destructive activities etc. is the need of the hour. The curriculum should also uphold the enquiry how environment and development can go hand in hand and perspectives regarding sustainable development and views. One of the aims of the curriculum is to present perspectives on consistent development and create a comprehensive awareness about environment.

Adolescent Education

The possibility of including content areas on adolescent education should be explored with the help of child psychologists, health workers, doctors and teachers. It is also important to address the doubts of learners regarding health and hygiene in a scientific manner.

Consumer Culture

Facts concerning the negative aspects of consumerism have to be included in the curriculum. Consumer laws and our rights as consumers should delt with in the curriculum.

Anti-drug and intoxicant attitude

We should realise the harmful effect of alcohol, drugs, tobacco and other narcotics on the health of children. The future generation should be saved from the evil tentacles of this menace. Pictures, pamphlets and visuals on the physical and mental effects of drug abuse, as examples, can be included in the content areas.

Gender Justice

The curriculum should ensure gender justice and gender equality. Discrimination on the basis of gender should not be reflected in the content areas. It is the responsibility of teachers to ensure gender justice while carrying out learning activities.

Frugality

Children should be taught the basic lessons of frugality at the primary level itself. Explain the importance and relevance of the habit of frugality. Students can also be given practical training in frugality.

Road Safety

Traffic rules and practical suggestions to avoid road accidents are part of road safety. Children should develop the civic awareness that the road is a public place and that everybody has the right to use it. Activities related to road safety should also be given importance.

Learning experiences in these areas should be incorporated naturally in the transaction of the curriculum. While choosing the concepts of various subjects and arranging learning activities, enough consideration should be given. Knowledge, skill and attitude should be stressed in the process of teaching learning process. It should also be possible to perform continuous evaluation to find out whether the objectives have been accomplished. Activities of various clubs, SPC, NCC, Scouts and Guides, JRC, Vidya Rangam, Kalasahithya Vedi, Gandhi Darshan etc., can be platforms to develop values, attitudes and commitment.

Right Based Education

UNESCO had taken initiatives to decide on the rights of children and spread them world wide. As a result of this, legislation has been made in many countries to protect the rights of children. The Right to Education Act passed in 2009 in India, is an important milestone in this matter. The responsibility of protecting the rights of children becomes the duty of adults. Right to Education can be divided into three areas.

- Participation
- Provision
- Protection

Participation

- My opinion is sought when decisions concerning me / children are taken.
- My interests are given priority when decisions are taken.
- I am given the opportunity to participate in activities which are compatible with my ability and limitations.
- I am able to go through a learning process which is flexible enough to nurture my abilities and overcome my limitations.

- My opinions are given due respect and value.
- My friends and I get active participation in the activities in class.
- I get opportunities to display my talent and abilities.

Provision

- I get the service of teachers who have the required qualification and who constantly update their knowledge.
- I get learning -experience in the prescribed time.
- I get a classroom ambience conducive to physical and psychological growth.
- My teachers are able to make learning materials required for learning activities available.
- I get materials and opportunities for the growth of art and physical education.
- I also get career guidance for securing employment in future.

Protection

- I do not experience any kind of discrimination in or out of school.
- I am not ignored by any one in any manner.
- I am not harassed either physically or mentally.
- I can interact with my teachers without any fear.
- Though I am a child, every one respects and values my privacy.
- I am convinced that I will be safe both at home and at school.
- My school lends me a helping hand to further strengthen and empower me when I face physical and emotional problems.

If these are the rights of children, how far can I ensure these rights? What steps should I take further to ensure these rights? Every teacher should think about this.

Mentoring

RTE considers the teacher as a 'mentor'. Mentoring has much relevance and significance in the comprehensive school development project.

The teacher - student relationship has undergone significant changes. A teacher should function not as a person who distributes / dispenses knowledge, but as a facilitator who co-ordinates the various opportunities of students to gain knowledge.

In reality, school is a second home for the child and teachers are the members of his/her family. A teacher should understand that all children do not receive love, consideration, security, appreciation and recognition etc., equally at home. The responsibility of a teacher becomes complete only when he/she realises this and is able to express these feelings accordingly to each child. Only then will a school become a home.

Only when a teacher becomes a mentor and a facilitator who helps gain learning outcomes, he/she will be a teacher of the new era.

When the teacher becomes a co-guardian, children get guidance, advice, support and opportunity to improve. The teacher as mentor should make interventions in the role of an experienced predecessor. Assistance for awareness and counselling are part of this. An effective mentor can bring out the hidden talents of a child.

Through mentoring:

- the teacher and the student enjoy proper learning experiences.
- the knowledge-area of the child and the teacher widens.
- the bond between the student and the school is strengthened.
- personality development and learning development of the child are ensured.
- collective thinking, decision- making and collective effort are made possible.
- the relationship between parents and school is strengthened and an overall view of the learner's learning process is created.
- the participation of the learner in arts and sports can be assessed.

Mentoring has to be manifested as a process which caters to personality development and interest in learning. It should also help in continuous assessment. Notes related to mentoring experiences should be recorded in the Cumulative Record. All the teachers in the school should act as mentors of students. All learners should get an experience of mentoring. The class may be divided into small groups and different teachers can be given the responsibility of evaluating the progress of each group.

Code of Professional Ethics for School Teachers

1. Responsibility towards Students

The teacher;

1.1 *Treats all students with love and affection.*

1.2 *Respects the value of being just and impartial to all students irrespective of their caste, creed, religion, sex, economic status, disability, language and place of birth.*

1.3 *Facilitates students' physical, social, intellectual, emotional, and moral development.*

1.4 *Respects basic human dignity of the child in all aspects of school life.*

1.5 *Makes planned and systematic efforts to facilitate the child to actualise his/her potential and talent.*

1.6 *Transacts the curriculum in conformity with the values enshrined in the Constitution of India.*

1.7 *Adapts his/her teaching to the individual needs of students.*

1.8 *Maintains the confidentiality of the information concerning students and dispenses such information only to those who are legitimately entitled to it.*

1.9 *A teacher refrains from subjecting any child to trauma, fear, anxiety, physical punishment, sexual abuse and emotional and mental harassment.*

1.10. *Protects a child from all forms of sexual abuse.*

2. Obligations towards parents, community and society

A teacher;

2.1 *Establishes a relationship of trust with parents/guardians in the interest of the all round development of students.*

2.2 *Desists from doing anything which is derogatory to the respect of the child or his/her parents /guardians.*

2.3 *Strives to develop respect for the composite culture of India among students.*

2.4 *Keeps the country top most in mind, refrains from taking part in such activities as spreading feelings of hatred or enmity among different communities, religious or linguistic groups.*

3. Obligations towards the profession of teaching and towards colleagues:

A teacher:

3.1 Strives for continuous professional development.

3.2 Creates a culture that encourages purposeful collaboration and dialogue among colleagues and stake holders.

3.3 Takes pride in the teaching profession and treats other members of the profession with respect and dignity

3.4 Refrains from engaging himself/herself in private tuition or private teaching activity.

3.5 Refrains from accepting any gift, or favour that might impair or appear to influence professional decisions or actions.

3.6 Refrains from making unsubstantiated allegations against colleagues or higher authorities.

3.7 Avoids making derogatory comments about colleagues, especially in the presence of pupils, parents or colleagues.

3.8 Respects the professional standing and opinions of his/her colleagues

3.9 A teacher maintains confidentiality of information regarding colleagues and dispenses such information only when authorized to do so.

Teacher Planner

Teacher planner is a record of daily teaching planning. The teacher should develop the process page by carrying out the activities given in the teacher text and text book with the aim of achieving learning outcomes. However, these activities should be done in a flexible manner, adopting techniques suitable for the students of her class.

The process page should contain planning that includes assessment along with learning activities. Information obtained through continuous assessment should also be included on the feedback page.

A teacher planner should contain learning activities conducive for precise and meaningful concept- formation. The teacher should prepare a reflection note based on the information gathered through learning activities and assessment implemented in a week. It should be discussed in SRG / Subject Council. Further planning notes should be made by the teacher based on these notes.

The format of a teacher planner is given below.

<table>
<tr><th colspan="2">Teacher Planner</th></tr>
<tr><td colspan="2">Name of the unit/ lesson :
Date :
Expected time :
Learning outcomes :
Concepts / Ideas :
Skills :
Language elements
(only for language) :
Discourses
(only for language) :
Values, Attitudes :
Learning aids :
Expected Products :</td></tr>
<tr><td>Process Page</td><td>Assessment Page</td></tr>
<tr><td>Process containing activities and assessment.</td><td>Assessment details should be included here.</td></tr>
</table>

Reflections

My findings, realisations

(Based on the ideas obtained through the assessment of learning activities)

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-
-
-

Extended Activities and Remedial Measures - Hints

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-
-
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ASSESSMENT APPROACH

Learning is a natural and continuous process. For effective learning, learning experiences should be based on specific objectives and centred on learning outcomes. Teachers and learners should be aware of the concepts and skills to be acquired through learning. Learning strategies should be planned according to the learning outcomes associated with each lesson. They should be linked to real life situations and presented to the learners.

How far are the acquired concepts and skills sufficient in ensuring learning outcomes? How many learners are yet to acquire the learning outcomes? What are the extended activities to be provided? How can they be provided? These should be the concerns of teachers as part of assessment.

Assessment **of** Learning is the process of assessing the learning outcomes acquired after the transaction of a unit. The proficiency of the learner and his level of excellence are evaluated here. This is just one phase of assessment.

There is also a process of correction which involves a critical self analysis of the concepts and awareness gathered through learning and internalizing the changes. This can be considered as self-assessment. Thus, learning takes place through self-assessment. This can be called Assessment **as** Learning. The learner becomes aware of how to learn more effectively (Learning to Learn) through this.

Assessment for learning and assessment as learning should be intensely emphasised to make learning more effective. The approach which gives importance to assessment process for making learning more effective must be adopted.

Continuous and Comprehensive Evaluation (CCE)

Learning is a continuous process taking place in the learner. Hence, the assessment process to examine the concepts and skills acquired should also be continuous. By comprehensive assessment, we mean the assessment of the learner in cognitive as well as socio-emotional areas. Hence, we have adopted a continuous and comprehensive evaluation system.

CCE Areas

CCE is carried out in two areas;

1. Cognitive area
2. Socio - emotional area

Assessment regarding development in cognitive domain

The subjects taught at higher secondary level like Language, Science Humanities, Commerce, Health and Physical Education come under cognitive area. Learning outcomes acquired in each subject should be evaluated. Two types of evaluation are suggested here.

1. Continuous Evaluation (CE)
2. Term Evaluation (TE)

Continuous Evaluation (CE)

Three types of CE are suggested.

1. **Learning Process assessment**
2. **Portfolio Assessment**
3. **Unit based assessment**

1. Learning Process Assessment

Both the teacher and the learner plan various activities to acquire learning outcomes. The teacher has evaluated various factors like the participation of the learner in the learning process, excellence of the learner in performance and presentation, creativity of the learner, acquisition of desired skills etc. The indicators given below can be used for evaluation.

1. Participation in activity
2. Conceptual understanding
3. Acquisition of skills
4. Performance / Presentation
5. Recording / Preparation

When the process -assessment is carried out, the assessment done should be based on each indicator. For example, when evaluation for the indicator 'participation in activity' is done, the learners should be categorized as excellent, good, average and those who need improvement. This has to be recorded in the page for assessment in

Teacher Planner. All learners have to be assessed and recorded with reference to each indicator in every term.

Opportunity for self-assessment, peer assessment and teacher-assessment should be given in process-assessment.

Activity log

Activity log is an important document required for the assessment of the cognitive area. It helps to complete various activities according to learning processes. The creativity of the learner, thought processes, language skills, socio- emotional domain etc are reflected in the activity log. An activity log should contain details like the various strategies adopted for the transaction of lesson. The additional information given by teachers to strengthen the learning process too can be recorded in the activity log.

2. Portfolio Assessment

Portfolio is the collection of all products formed during the various stages of learning activities. It has the duty to give a learner, parents and the teacher feedback regarding learning.

The following should be included in a portfolio.

- Activity log
- Other learning documents, pictures, collections, writings, learning materials, creations made through ICT etc.
- Creative works
- Work sheets

The following indicators can be used for portfolio assessment.

- Clarity of concept
- Attainment of concepts
- Appropriate design
- Completion
- Originality

Method to calculate scores of learning process and portfolio

It is not necessary to record the score of all students calculated using indicators given for each activity. Performance of an entire term should be evaluated using the indicators. The notes in teacher planner, records in activity log etc should be consolidated at the end of each term and learners should be categorised on the basis of their participation as Excellent, Good, Average, and Need improvement and 4/3/2/1 scores should be given accordingly. All five indicators have to be considered and score should be given for each indicator. The maximum score can be calculated as 20.

3. Unit based Assessment

In a unit, activities for various learning outcomes are distributed in an inter-related manner. This is comprehensive in nature. While assessing a unit, this comprehensiveness (considering all the learning outcomes) is assessed. Oral assessment, quiz programme, open book assessment, preparation of questions, identifying the indicators and assessment of creative writing can be considered for unit assessment. Rating scale and check list to measure the achievement of a learner in a particular unit can be used. Unit assessment should take place naturally along with learning.

For unit assessment, points have to be awarded on the basis of indicators and converted to grades. These grades have to be recorded in the prescribed format. As there is more than one assessment in a term, the average of the assessment of all the units has to be recorded at the end of the term. Teacher has to prepare indicators suitable for the tools used in assessment.

Open Book Assessment

An “open book assessment” is one in which examinees are allowed to consult their class notes, textbooks, and other approved materials while answering questions. It is ideally suited to programmes that especially aim at developing the skills of critical and creative thinking. The open material may take one of the main forms; a textbook or alternative reference materials, or the students’ own notes. The types of material allowable must be made explicit to all students in advance of the assessment. Open-book assessments often comprise tasks based on a problem or argument to which the student is then required to respond, employing their knowledge of the subject and making use of the reference material as appropriate. Unit based assessment can be done in the form of open book assessment. It can be given after completing the unit, integrating all the learning outcomes. This assessment can be given for individual attempt first. Then the same can be allowed to be discussed in groups. Thus learning can be ensured in every learner.

Advantages of open-book Assessment

- They assess not only students' capacity to construct a coherent response to the assessment task, but also require a demonstration of their ability to use resource material effectively.
- By allowing students access to relevant reference material, open-book assessments reduce the need to memorise information, and can therefore allow students to concentrate on demonstrating their ability to understand and apply this information to the question.
- By providing students with reference material prior to the assessment, it may give them greater confidence when taking these assessments and therefore produce a more accurate account of their achievements.
- Students can use revision time more constructively, focusing on reinforcing their understanding of the subject rather than attempting to memorise information.
- Home assignments and other learning experiences already prepare the students to solve problems with the assistance of external resources, so open-book assessments are quite natural in nature.

Preparing for an Open Book Assessment

- Read the chapters ahead of time. Don't expect to find quick answers during the assessment.
- Know where to find everything. Observe the concepts and make your own outline. This reinforces the structure of the content in your mind.
- Mark all important terms with sticky notes and flags. If the teacher allows it, mark your texts wherever you notice important concepts and terms.
- Review notes for themes. Your teacher's comments usually provide an overview of the themes and concepts that appear on assessment. You won't always get this by reviewing the book alone.
- Make your own notes if allowed, and write down important formulas or concepts that you've covered in class.

Method of calculating CE

The maximum score for learning process, portfolio and unit based assessment will be 20 each in every subject. Term level recording can be done calculating the average of them. To consolidate these marks, the format given in Annexure - 1 can be used.

Term Evaluation (TE)

It is essential to assess the learning outcomes achieved through learning activities by each learner at the end of every term. The assessment of languages should be made considering areas like discourses, language elements, language skills based on the learning outcomes in the units considered in each term. Question models can contain various questions which stress the content areas and skills. For other subjects, assessment should be done based on the content- area of units considered in the term. Questions to assess skills and ideas which lay stress on learning outcomes can be prepared.

The question paper should be prepared after first preparing a design and then a blue print of question paper giving proper weights to units and learning outcomes, various thinking skills and different form of questions. Suitable scoring key and marking scheme should be prepared for each question and assessment should be done based on this scheme. Question-wise analysis should be prepared to review whether the questions are in accordance with the blue print and necessary editing should be done in the questions.

Details of thinking skills

Thinking skills are the mental processes that we apply when we seek to make sense of experiences. While setting the question paper, due weight should be given to the thinking skills, so as to ensure meaningful learning in every learner. Coverage of the range of skills has to be ensured in the question paper which expects the learners to respond within a stipulated period of time of assessment, keeping in view the difficulty level.

According to Anderson and Krathwohl ('A Taxonomy for Learning, Teaching and Assessing – Revised Blooms taxonomy') the range of categories, specific thinking skills / processes with its alternative processes / terms is given as follows;

CATEGORY/ PROCESSES	ALTERNATIVE TERMS
1. Remember	**Retrieve relevant knowledge from long-term memory**
1.1. *Recognising*	identifying- (e.g. Recognize the dates of important events in Indian history)
1.2. *Recalling*	retrieving - (e.g. Recall the major exports of India)
2. Understand	**Construct meaning from instructional messages, including oral, written and graphic information**
2.1. *Interpreting*	clarifying, paraphrasing, representing, translating (e.g. Write an equation [using B for the number of boys and G for the number of girls] that corresponds to the statement 'There are twice as many boys as girls in this class')
2.2. *Exemplifying*	illustrating, substantiating (e.g. Locate an inorganic compound and tell why it is inorganic)
2.3. *Classifying*	categorizing, subsuming (e.g. Classify the given transactions to be recorded in Purchase returns book and Sales returns book)
2.4. Summarising	abstracting, generalizing (e.g. Students are asked to read an untitled passage and then write an appropriate title.)
2.5. Inferring	concluding, extrapolating, interpolating, predicting (e.g. a student may be given three physics problems, two involving one principle and another involving a different principle can be asked to state the underlying principle or concept the student is uses to arrive at the correct answer.)
2.6. Comparing	contrasting, mapping, matching (e.g. Compare historical events to contemporary situations)
2.7. Explaining	constructing models (e.g. the students who have studied Ohm's law are asked to explain what happens to the rate of the current when a second battery is added to a circuit.)
3. Apply	**Carry out or use a procedure in a given situation**
3.1. Executing	Carrying out (e.g. Prepare Trading and Profit and loss Account from the Trial Balance given to and find out the net profit.)

3.2. *Implementing*	using (e.g. Select the appropriate given situation where Newton's Second Law can be used)
4. Analyse	**Break material into its constituent parts and determin how the parts relate to one another and to an overall structure or purpose**
4.1. *Differentiating*	discriminating, distinguishing, focusing, selecting (e.g. distinguish between relevant and irrelevant numbers in a mathematical word problem)
4.2. *Organising*	finding coherence, integrating, outlining, parsing, structuring (e.g. the students are asked to write graphic hierarchies which best corresponds to the organisation of a presented passage.)
4.3. *Attributing*	deconstructing (e.g. determine the point of view of the author of an essay in terms of his or her ethical perspective)
5. Evaluate	**Make judgements based on criteria and standards**
5.1. *Checking*	coordinating, detecting, monitoring, testing (e.g. after reading a report of a chemistry experiment, determine whether or not the conclusion follows from the results of the experiment.)
5.2. *Critiquing*	judging (e.g. Judge which of the two methods is the best way to solve a given problem)
6. Create	**Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure**
6.1. *Generating*	hypothesizing (e.g. suggest as many ways as you can to assure that everyone has adequate medical insurance)
6.2. *Planning*	designing (e.g. design social intervention programmes for overcoming excessive consumerism)
6.3. *Producing*	constructing (e.g. the students are asked to write a short story based on some specifications)

Health - Physical Education - Assessment Method

Health - physical education will be considered as a cognitive area from 2014-15 academic year. During the adolescent stage, the physical and mental development of a child strengthens further. The learners should be given the opportunity to get a proper awareness of health habits and the need to engage in physical activities. A performance assessment of the health - physical education is suggested. Details regarding this are given in the higher secondary level source book.

Assessment in Socio - Emotional Area

Assessment of social and emotional areas is as important as that of cognitive areas. Skills relating to Learning to know, Learning to do, Learning to live together and Learning to be should be considered here. The assessment of social and emotional areas should consider the following skills.

1. Communication skills
2. Interpersonal skills
3. Empathy
4. Coping with emotions
5. Coping with stress
6. Problem solving skills
7. Decision making
8. Critical thinking
9. Creative thinking skills
10. Self- awareness

The assessment should be carried out by teachers handling various subjects in cognitive areas. This assessment should be carried out as part of the learning process assessment in each subject. Along with the assessment of process skills, the assessment of related values and attitudes too should be done.

The skills in the socio - emotional area that can be beneficial for the proficiency of the learner should be identified and marked. The skills beneficial to each learner should be encouraged. The teacher can record these proficiencies in the Teacher Planner and the consolidated information in Annexure - 2.

Artistic, Social, Cultural and Vocational Proficiencies

To ensure the all-round development of a learner at the higher secondary level, not only appreciative, creative and artistic skills should be encouraged but an attitude towards undertaking social-cultural services should be inculcated. Every learner should get an opportunity at least once in a month to participate in such activities. Higher Secondary Youth Festival, Career Guidance, Social Extension activities, National Service Scheme, N.C.C and various clubs should be made use of towards this effect.

All students at the higher secondary level should participate in atleast one of these activities. The proficiency of the learner in participating can be given a special grade certificate.

For Excellence in activity	-	A grade
Good	-	B grade
Satisfactory	-	C grade
Participation	-	D grade

Assessment - Annual Consolidation

The annual overall score of CE is the best score obtained by the learner in 3 terms. This can be entered in the column titled 'Final Score' in the format given in Annexure - 2. It is the total CE score of the learner in each subject. Now find the TE of each subject and find the total score adding CE and TE. This is the total score of a learner in one subject. In the case of subjects with practicals, the final score is calculated by including the score for practicals too.

Grading Scheme

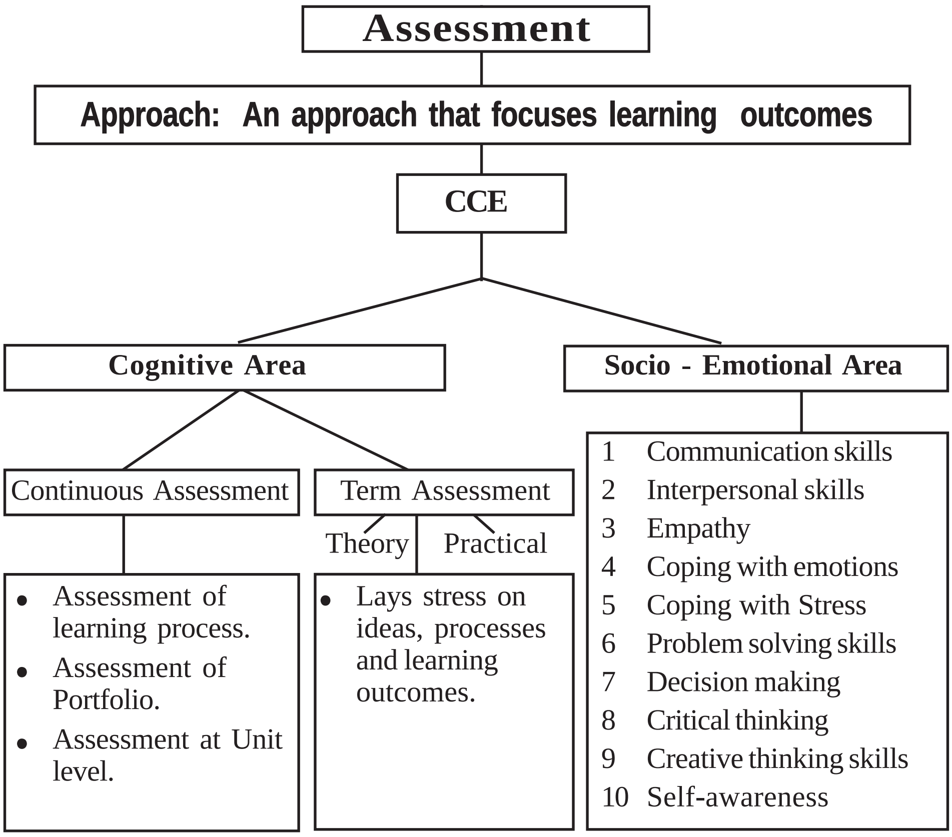
Higher Secondary level employs grading system to assess subjects in cognitive area. 9 Point Absolute Grading is used for this.

The table given below can be used for this.

Score 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

To be eligible for higher studies, the learner in the higher secondary should get a minimum of D+ (30-39 %) for each subject in the combined score of CE +TE (Public exam). In addition, he should score a minimum of D+ for TE too.

The formats for assessment are given as Annexure I and II.



SUBJECT APPROACH

It can be said that Science is the sum of all experiences gained by humans hitherto. Such experiences are interpreted in the light of earlier experiences. Our surroundings come live to our experiences through sight, hearing, taste, touch and smell. The proper analysis of the experiences on the basis of earlier knowledge leads us to the construction of new knowledge. Every piece of knowledge thus constructed is a window for further enquiry. Logical thinking becomes effective through asking logical questions, collecting relevant information and conducting comprehensive analysis. This is the method of science learning. There will be no superstitious beliefs and wrong ideas in a society that follows this method. Such a society will not suffer exploitation or deceit. Hence science is effective armour too. The method of science is to be applied to all fields of life and therefore science learning should not be limited to a mere assortment of data about energy, substances and living things. Science learning has broader objective beyond this.

Learning Objectives of Science

- nourish wonder, curiosity and observation skills.
- scientifically explain surroundings
- strive for improvement
- assimilate and execute the method of science.
- investigate constantly and draw conclusions after analysing data.
- analyse natural phenomenon
- eliminate superstitious beliefs and evil practices
- prevent the misuse of science
- develop scientific perspective
- cultivate eco-friendly attitude
- identify mutual interdependence in nature
- use the assimilated knowledge for the welfare of all creatures

- extend the concept of sustainable development
- relate learning to daily life situations
- acquire physical-mental-social health by observing personal hygiene and social hygiene.
- cultivate a scientific consciousness based on humanity
- appreciate the achievements of science
- use the achievements of science for social welfare.
- respect those who offered lives for science.

Science Education - Approach

To achieve the above said objectives, we have to keep on constantly improving the learner approach we adopted in Science Education. The traditional view that science education is the process of imparting the knowledge assimilated through the years about the universe had changed around forty years ago. It was after that the view that the process of science is as important as the content, came into the realm of science education. However, today, the approach that certain other facts beyond content and process are also to be considered, has gained significance. Discussing Mc Vormack and Yager's 'Taxonomy for Science Education' becomes relevant in this context. According to this, there are five domains that science education must lay emphasis on.

Knowledge domain

Science students are expected to know scientific principles and available scientific facts. It is through science learning that a clear idea about universal phenomena, the relation between them and there explanations are gained. The following are primarily included in this domain:

- facts
- concepts
- rules
- temporary inferences and laws used by scientists currently
- science and social issues

An understanding of this area can be created through experiments and observations, discussions, debates, project activities and references.

Process domain

This domain lays emphasis on knowing how scientists create new knowledge and on producing knowledge by oneself and learning to learning. This domain gives importance to gain the scientific method and developing interest for deeper investigation.

Process is a chain of procedures used with purpose of a particular result or to achieve a particular aim. Process skills are skills that enable identifying concepts and evidences, and after collecting then, analysing and drawing conclusions.

Concept formation is an essential factor of not only science learning, but the learning of all subjects. It is because of gaining the concept 'life' that a creature, not seen before, can be identified as a living thing. Similarly it is the result of comprehending the concept 'dissolving' that it can be concluded that an unknown substance that disappears in water, does not vanish but gets dissolved in water. Concept formation regarding science facts is very important. However the students should go through the education process to attain proper concept assimilation. The concept created by the students through experiments and observations, collecting evidences and analysis, daily life. This substantiates the fact that learning should be process-based.

A few important process skills

- observing
- collecting and recording data
- classifying
- measuring and preparing chart
- explaining and analysing data
- engaging in experiments
- identifying and controlling variables

- raising questions
- arriving at generalisation
- identifying solutions of problems
- formulating hypothesis and examining it
- arriving at conclusions
- taking decisions
- communicating and understanding communication of others
- foretelling and assuming
- handling instruments
- using number relationship
- using space - time relationship
- Predicting
- Inferring
- making operational definition
- Interpreting data

Observing

Observation is the process of acquiring knowledge through the five senses. Learning experiences which provide the opportunity to use all the five senses may be used.

Classifying

The process of grouping information gained through observation, based on salient features is called classifying. Starting from simple groupings of data, it can extend to the level of classification into minute sub groups. The ability to classify will vary according to the age, maturity and cognitive level of the students.

Using number relationships

This involves the analysis of available data, consolidation and meaningful explanation using the language of mathematics. Learning experiences may provide the opportunity to develop the skills of counting, addition, subtraction, multiplication, division and finding averages.

Measuring & Charting

As part of data collection the student will have to measure quantities such as length, time, mass, temperature, force and density. What instruments are required for this? How can these instruments be used? What is the level of accuracy expected in measurements? How to record the data? All these are to be considered.

Using Space-time relationships

An in-depth enquiry relating to shape, distance, movement, speed, accuracy, direction and time comes under this area. It begins from identifying the shape, speed, direction and other such features of objects.

Communicating and understanding communication

It is essential that knowledge developed is expressed in different ways - oral and written. The students need opportunities to communicate through tables, graphs, pictures, models, short write-ups, descriptions and lectures and also to take part in debates and discussions. Clarifying doubts by asking appropriate questions is another skill in this area.

Predicting

An inquisite person attempts to answer the question if......... then? and proceeds to try out the guessed answer. Answer to this question is important in science. The teacher expects the student to predict the outcome of various events and experiments. Students need to develop the skill of predicting by drawing on the knowledge gained through experiments and observations.

Inferring

Observation and data collection are not important in themselves. Inferences based on them are however, crucial. A proper inference can be drawn only if the student has good skills of analysis. The defects in analysis of data will affect the quality of inference.

Making operational definitions

The meaning of ideas need to be stated precisely and clearly to make them useful. This helps in communication. Operational defintions may be incomplete and temporary. But in given situations they can be logical and practical.

Formulating hypothesis

A hypothesis is a temporary conclusion drawn using insight. A problem can have a number of casual factors and solutions. Based on knowledge and experiences relating to the problem the causes and solutions can be guessed. Such a guess is a hypothesis and need to be tested out and rejected if disproved. Hypothesis which are proved right become conclusions.

Interpreting data

Interpretation of collected data may lead to new ideas and generalizations. Opportunities may be provided for interpreting data and formation of new ideas.

Controlling variables

Variables influence the outcome of experiments. Variables are to be controlled during experiments. For the experiment to be accurate and scientific the variables are to be effectively controlled.

Experimenting

An experiment is a planned activity to test the validity of hypotheses drawn. Experimentation contains the process skills in an integrated way. It is the main method used by scientists. Formulating methods to test the hypothesis, conducting experiments, recording, interpretation of data and drawing conclusions are included in it.

The duty of the teacher is to help the learner to acquire the method of science in a natural way through learning activities based on simple & complex process skills starting from observation. The students are to be given learning experiences that are learner-centred, process oriented, and environment based and not the conventional content/ product oriented experiences. When this approach is followed along with process skills the student acquires knowledge, facts, ideas, concepts and principles.

In the new approach of curriculum, the student forms ideas and conclusions through processes. Project activities, seminar presentations and experiments enable the student to employ more than one process skill.

Creativity domain

Science education is considered today as a process enabling the student only in achieving certain scientific information. This is a point of view that totally ignores the student's creativity and imagination. It is essential that the student is able to deviate from the conventional path and think differently.

A few skills pertaining to this domain is given below-

- visualizing, formulating experiments
- relating objects and concepts in new ways
- identifying alternative / not usual uses for objects
- finding solution for problems and puzzles
- fantasizing
- designing instruments and machines
- dreaming'
- thinking differently

Attitudinal domain

One of the main aims of Science Education is the desirable change in attitudes and value teaching. It cannot be said that there is any benefit in daily life by science education if there is no substantial change in perspective of life and in the stand towards social or individual problems, even if concepts and process skills are attained. It is commonly seen in our country that even people who possess higher degrees in science adopt unscientific stands in day-to-day issues. Therefore science education should examine the problem of skill development in areas like attitudes, values, decision-taking etc, more closely.

factors that may be included in this domain -

- faith in one's abilities
- ability to understand human feelings and respect them
- expressing one's emotions and thoughts creatively
- thinking rationally about individual values and taking decisions accordingly.

Application domain

The concepts, processes and values become meaningless if the student cannot implement them in daily life. Similarly, pure scientific principles and concepts divorced from technology, will not have much relevance in daily life. Scientific information is seen to be irrelevant for the student if it is not related to daily life.

These are some factors in the Application domain:

- observing instances of science concepts in day-to-day life
- use the concepts and skills gained to solve problems related to life.
- create an idea of science concepts related to household instruments.
- ability to evaluate events and developments related to science
- take scientific decision on matters of food, health, life style etc.
- relate science to other subjects

Method of Science Learning

These objectives can be realized only when the scientific method is adopted for science learning . Science learning should be process-based. Activities that ensure the development of skills like collecting information appropriate for problem-solving. analysing the information, arriving at proper conclusions, examining the conclusions, using them in new contexts etc, are to be conducted in the classroom. Science learning should not be restricted to the classroom. Hence outdoor learning also should be emphasized.

While saying that science learning should become process-based, it does not mean that it is merely conducting activities. Each activity must have an objective. It should be ensured that the student has reached the objective. Conducting activities and not consolidating may not help acquiring the result. The student must be able to identify what he/she has achieved when a learning process is completed. This will help him/her for further studies.

Conclusions are made on the basis of the evidences got from learning activities. The evidences and the conclusions made therein have to be evaluated critically. While subjecting the method followed and the activities to evaluation again, the opportunity to identify errors, if any, and rectifying them opens up. The derived concepts are accepted or rejected only after subjecting them to criticism with high standards of academic discipline. This is possible only in classrooms that function in a democratic way where there is room for free and fearless interaction.

Concept formation occurs during interaction with the teacher, interaction with friends, observation or engaging in experiments. Hence the student gets various kind of experiences.

Teaching Learning Strategies

The explosion of knowledge has resulted in a new vision of knowledge. Earlier, it was thought that the most effective method was the transmission of knowledge by teacher to the student. However, the modern view is that the student has the responsibility and the right to construct knowledge. The teacher of modern times hence has to use instructional approaches that motivate the student to construct knowledge on his own.

Instructional strategies should be viewed as a social skill which is part of the educational environment and not as a technique to be mastered. They are to be considered as important components of teacher-student interaction and not as teacher activities alone. While instructional methods are planned the social and psychological aspects of the learner need to be taken into consideration.

Let us examine some instructional strategies helpful in attaining the learning outcomes of electronics.

Project

Project is one of the most suitable methods of instruction for science. It is a method of self instruction using the method of science and useful in the development of a number of process skills and hence it is essential to use projects in science education.

What is a project?

When a problem is felt, data regarding the problem is collected. The collected information is summarised and analysed. The conclusions that are obtained from analysis are used to solve the problem - these steps reflect the essentials of a project. By doing projects the students are given the opportunity to train in the method of science. In doing so, the student acquires problem solving ability which helps to tide over problematic situations in life and progress in life.

Projects help to develop scientific temper, scientific attitude and interest in learning science and to ensure active participation of the student in learning activities.

Stages of a project

I. Feeling the problem

The project topic should not be arbitarily created. It should reflect a felt problem in the learning situation and which requires a solution to proceed further.

Project topics arise when discussions relating to lessons are held in the class. It is important that the student has an internal urge to find out a solution to the particular problem. When the topic is presented the teacher must ensure this.

II. Defining the aim

If the student is to tackle the problem in a way suitable to his/her abilities, thinking skills and available facilities, the aim of the project need to be defined precisely. To state the aims of the project simply and clearly, the student needs the help of the teacher.

III. Planning

a. Hypothesizing

Drawing temporary conclusions on the basis of information available at the time is known as hypothesising.

Hypothesis of the project may be

b. Methods and instruments

Study methods and instruments are to be selected based on aims of the project and the hypothesis drawn. The nature of the topic, instruments used and the scientific approach followed should be correlated. Some methods and instruments are listed below.

Survey

Once survey method is selected, where, when and how to conduct the survey must be decided. What will be the sample and who are to be approached for data will also be considered. Questionnaires and survey forms are to be drawn up. During the planning phase all these are to be discussed in detail. Teacher must interact with the students, give suggestions and ensure that the instructions are suitable and effective.

Experimentation

When experimental method is to be used, it must be considered whether necessary equipment is available. If not can these be improvised? How can materials and instruments be made availalble? These questions must be considered.

C. Tabulation of data

- What information is to be collected?
- What method can be used for collecting information?
- When should observations be made?
- How to tabulate data?
- Are pictures, samples, and working models required?
- Are checklists, rating scales and score cards needed?
- The method of analysis should be decided in advance. Keeping to schedules, honest collection of data, accuracy of data and precision are important.

D. Analysis

The collected and tabulated data can be analysed to examine the validity of the hypothesis. The collected data need to be classified and compared. Comparison with standard information may also be required.

Graphics and similar representation will make the analysis easier.

E. Conclusion

Based on similarities, differences and relationships evident from analysis of data, the validity of hypothesis may be examined. Those found invalid are rejected and others are accepted as conclusions.

IV. Execution of the project

An outline of the project based on the components discussed above may be drawn up. The project activities may be carried out according to this plan with necessary modifications at the appropriate stages. Difficulties faced during execution of the project, data obtained and information collected, are to be entered in the 'activity log book'. This will be helpful during report writing.

Visits made during the conduct of the project, experiments, arranging equipment, recording data and analysis should be supervised by the teacher. Teacher must take care to conduct discussions, with students frequently to evaluate the progress of the project.

Application

The suggestions that arise from the project must be used for problem solving where ever applicable.

V. Project report

Report is to be prepared by the students themselves. The structure of the report should be finalised through discussion with the students. It must be ensured that it is not too complex and hinders activities.

- The cover page may show title of the project, name of the student/members of the group, and school address.
- The report may contain

1. Title
2. Introduction
3. Hypothesis/Aims
4. Method of study
5. Collected data
6. Analysis and Conclusions
7. Suggestions (if any)
8. Reference (if any)
9. Appendix (questionnaire, observation schedule, checklist etc.)

the activity log book should be made use of to prepare the project report. The aims and method of study of the project would be recorded in the project diary during the time of execution of the project. The credibility of the project and data can be established with the help of activity log book.

VI. Project Presentation

The project can be evaluated and the work done may be assessed when the project is presented. Ideas can be communicated and shared with others through presentation of the project.

The project can be presented in

- Class room
- Science club meeting
- Science fairs
- School annual day meeting
- PTA meeting
- Ayalkootam
- Other selected forums

The project method helps to train the students in the method of science to familiarise them with self study habits and to find solutions for local problems. We must take care to cultivate this as an important method of study in our schools.

II. Seminar

Reporting is a core component of learning science. In seminar, data relating to a specific topic is collected, analysed and presented as paper for the benefit of others. It helps the learner to improve his/her communication skills and provides opportunities for collection of secondary data and for drawing conclusions. It is useful in cultivating interests and attitude in science topics and in personality development. Topics chosen for seminars may be contemporary and should have social relevance.

Organization of seminar

- Topic presentation
- Finding out sub topics or different areas
- Group formation

- Assigning sub topics to different members of the groups. Each group prepare paper on all the sub topics.
- Discussion by each group on the sub-topics (books, magazines, institutions, place and person)
- Organising ideas
- Paper writing
- Seeking the opinion of the teacher.
- Presentation
- Discussion
- Summarising
- The teacher may provide reference materials and give directions at all stages.
- Writing of report
- The report may include new information gained through data collection, conclusions and findings.
- The information collected by all the members may be included.
- Tables, charts, books and other resource materials may be included.

Teacher may examine the paper at different stages and provide guidelines. The activities and participation of each student in the group may be assessed.

Paper presentation

- Teacher may function as the moderator during the initial stages, but it is better to assign this role to students themselves.
- All the group members must be present in the dias during presentation and must actively participate in the discussion after presentation by the leader.
- Questions from the audience are to be answered by group members taking turns.
- Teacher may intervene wherever necessary to provide instructions and help.
- When sub topics are presented, after all the presentations are over general discussion may be held. Teacher may summarise the discussion.

- A summarised version of the report may be recorded in the activity log book.

Seminar papers and reports may be kept in the information corner.

III Discussion

Discussion is an effective method in the teaching learning process. In the process approach it has a significant role. Discussions are essential for the student to share their findings, ideas and conclusions at each stage of learning with fellow students and teachers and to assess progress.

Group discussion is an ideal method to inculcate social consciousness, co-operation, democratic attitude, friendliness, open mindedness and compromising attitude which are the ultimate aims of education. It helps the development of communication skill, hypothesis formulation, designing of experiments and analytical skills.

General discussion is a method where discussion proceeds based on the thought provoking questions raised by the teacher addressing the whole class. Based on the random presentations of the group members teacher and students move ahead with the development of concepts. Finally teacher consolidates the concepts/ideas discussed in the class.

In a student centred classroom, the following points must be borne in mind while conducting a discussion.

Discussion points may be provided to guide the progress of the discussion.

This will help the students to reach the proper conclusion. Discussion points may be in the form of questions.

- During group discussion the teacher may observe each group and if needed help them to channel the discussion towards the common objective.
- All students may be given opportunity to take part and express their ideas.

- It must be ensured that time limits are observed.
- The conclusion reached may be entered by each student in the activity log book and a group representative must present these during consolidation.
- The teacher may correct or add to the conclusions and ensure that all the relevant ideas have been covered.
- Students may be instructed to enter the consolidated ideas in the activity log book.

IV Debate

After presenting a controversial topic, arguments in favour and against are put forward and a detailed analysis of facts is done by both sides in a debate.

Relevance of Debate

- To develop the skill of presenting ones views logically and argue convincingly
- To develop the ability to compare others views with ones own view and to understand relevant aspects or ideas of others.
- To develop leadership quality, democratic attitude and communication skills.

Conducting a debate

The selection of the debate topic must be done very carefully. A controversial topic (one which can be viewed from two different standpoints) is suitable for debate. Both viewpoints must help in cultivating certain positive attitudes in students.

The teacher must not take a stand favouring one group. An objective approach is to be maintained while presenting the topic.

Only then the students will prepare to debate both aspects. The processes in the debate are;

- Topic presentation
- Preliminary discussion - students are grouped into two.
- The two groups discuss the arguments they are going to present.

- Responsiblities assigned for presenting different viewpoints & arguments.
- Either the teacher or a student functions as the moderator.
- Each group present their arguments.
- Moderator present an analysis of the ideas and consolidate the points.
- Moderator present an analysis of the ideas and consolidate the points. Moderator may present the consolidation in tune with the method of science. The consolidated information is recorded in the activity log book.

Responsibilites of the moderator

- Introductory presentation
- Guiding the discussion
- Ensuring that the discussions are on right track
- Ensuring the time limits
- Consolidation of arguments

A model for planning

Stage 1 - 1 period

- Introductory presentation of the topic
- Grouping of students
- Group discussion
- Collection of information within groups
- Assigning reponsibilities
- Fixing date and time of debate.

Stage 2 - Debate

- Seating arangements
- Introductory remarks
- Presentation of arguments from two sides
- Discussion
- Consolidation

The moderator's main responsibility is consolidation. It must be unbiased, analytical and efficient as the role of a judge in weighing the merits of a legal point.

Stage - 3

- Preparing report on the debate.
- Entering the details of the debate in activity log book.

V Experiments

Experiments familiarise the students with the method of science and develops the process skills. It serves the following aims.

- Development of process skills.
- Ability to handle science equipments
- Development of interest in science, sense of responsibility, aptitude and attitude.
- Providing direct experience

Planning

- Must be related to curriculum objective.
- Introductory discussions must help the students to understand the need and aims of experiments. The students should develop an idea of what variables are to be controlled. Similary they should decide on what to observe. They are also to be instructed on the manner of recording and the safe handling of equipments and materials must be demonstrated to them. Above all experiments must be simple and practicable.
- Experiments must be suitable to the age and maturity level of students.
- Must be interesting to the student.

Points to note:

- If only limited number of equipments is available students may work in groups.
- Each group must be given appropriate instruction
- Experiments must proceed according to instructions given.
- It must be ensured that measurements are accurate.
- Observations must be recorded
- Time limits must be observed.

Teachers must be present during all stages of the experiment to provide necessary instructions.

VI Outdoor learning

Direct observation is essential for the development of ideas in a process based learning. It may be difficult to provide opportunities for this in all classrooms. Hence learning science within the confines of the class room is not advisable. Outdoor learning provides experience in the natural setings that cannot be provided through a class room situation or laboratory.

Relevance

- Learning becomes environment based
- Direct learning experiences are gained
- Learning is linked to real life and practical situations.
- Helps to share experiences with people who apply science in real situations.
- Develops values, attitudes and interests
- Helps to develop personal qualities
- Helps to evaluate the development of emotional domain.

Planning

- Lesson unit - Objectives intended
- What are to be observed? to be enquired? to be collected?
- How to record?
- What services of local community are needed?
- Place, travel facilities, expected expenses, materials needed.

Assessment

- Recordings in the activity log book and report.
- Participation of students
- Sharing of experiences and explanations given on questions raised
- Punctuality

VIII. Information Communication Technology

During a time of information explosion, comprehensive study of Physics cannot be limited to books alone. Information technology is a medium which can help one to collect and exchange new knowledge that is created by the minute. It helps us to study and understand phenomena which are not amenable to direct observation, new developments, habitats, and physiological activities. A contemporary mode of Electronics teaching requires the help of it to a great extend.

IX Assignments

Assignments are learning activities helping to achieve the learning outcome and also lead the pupil from the present level to a higher level of learning.

Assignments may be of the types - writings, drawings, construction of models etc. In assignments involving construction of models, a note on methods used in construction may also be submitted.

The discussion and planning may be carried out in classroom to complete the assignments in time. Clarifications may be given about the sources. Teacher may provide the sources if needed.

X Problem Solving

General Steps

- Analysis and data entry
- Selection of suitable equation
- Substitution and calculation
- Final answer with unit

For a class of 50pupils, 5groups can be formed. Problems are given in groups. Each students should go through the problem. They should follow the above criteria for solving the problem. After individual attempt, let them start group discussion. With the clarification, let them finish the problem and present the method of solving. After re -arranging the groups, they share the findings of each groups.

Different types of problems, can be given to groups and teacher should consolidate the findings.

XI Activity log book

The student carries out a number of activities as part of learning. Observations, collections, data organisations in tables, analysis, consolidation and reports are some of these. The activity logbook is a record of all activities that the student carries out in process based learning - problems faced, methods adopted to solve them and conclusions drawn. It is useful to the student as well as to others who want to assess the students work and progress.

The student must record all the information about activities. The activity logbook must help to record data systematically to analyse the collected data and to consolidate the ideas so as to share it with others.

In short, the activity logbook is expected to be a comprehensive record of learning of a year. It is a record of all the learning experiences in the subject that a student has undergone during a year.

XII School laboratory

Science learning should be laboratory-oriented also while it is environment-oriented. It goes without saying how important a systematic laboratory in school is ! The laboratory can be developed including the models and instruments constructed by students. The role of students during experimentation is not that of a spectator. The students should learn to handle instruments and chemicals without harm. For this, apparatus, substances and models should be available to the required number and quantity. The students should get the opportunity to choose and handle apparatus. Instruments and other substances should be classified and kept labeled. The classroom should become a laboratory and the laboratory a classroom.

XIII Science Library

The science library is as important as the laboratory. The school library is mostly used for language study. A lot of books related to the field of science are available now. Collect books that are beneficial for science learning and include them in the school library as a separate category. Besides extra-reading materials, magazines and reading notes pertaining each lesson can be arranged in the class-reading corner. The students reading have to expand to greater knowledge domains.

XIV Science Club

The School Science Club must transform into a platform for presenting instruments, innovative, seminar papers, projects, experiments etc made by students as part of their activities in the classroom. It is learnt that School Science Clubs function mostly for Science fairs only. This should change and the Science Clubs must become a means for promoting science aptitude among students. The club should start functioning in June itself and must prepare a years' action plan. A science exhibition can be held to exhibit the products of students at the end of the year. There are many opportunities for the science club like observing important days related to science learning, classes of experts on special topics, seminars etc.

SYLLABUS

1. **Power Supplies and voltage stabilizers**

   Need for a regulated power supply, Regulated power supply, load regulation, line regulation, Types of voltage regulators – Zener diode regulator and transistor series regulator, IC voltage regulators, Fixed voltage regulators – positive and negative, Adjustable voltage regulations – positive and negative, Typical DC regulated power supply design.

2. **Wave shaping circuits**

   Clipping circuits - positive, negative and biased, combinational clipper, Clamping circuits - positive, negative and biased, Differentiating circuits, integrating circuits, OP – amp circuits – voltage follower, summing amplifier, subtractor, integrator, differentiator, comparator, Filters – low pass, high pass, band pass, band reject.

3. **Digital Electronics**

   Combinational circuits, Multiplexer , Demultiplexer, Encoder, Decoder, Comparator, Sequential circuits, Flip flops, SR flip flops using NOR and NAND gates, clocked SR, JK flip flops, D flip flops, T flip flops, Binary counters, Shift registers (SISO only)

4. **Radio Broadcasting**

   Modulation, need for modulation, amplitude modulation – modulation index, frequency spectrum, band width, power relations, AM generation, AM demodulation, Types of AM, Frequency modulation – spectrum, band width, Comparison between AM and FM, Radio receivers – TRF and superheterodyne, Comparison between AM and FM band widths.

5. **Communication Systems**

   Basic communication system, Radio waves, long, medium and short waves, propagation of radio waves, ground wave, sky wave, Ionospheric layers, critical frequency, maximum usable frequency, skip distance.

6. Data communication

Sampling, Sampling theorem, pulse code modulation – quantization, A / D conversation, Multiplexing – Time division multiplexing, frequency division multiplexing, Digital modulation techniques – ASK, FSK and PSK.

7. Optical fiber and satellite communication

Basic fiber optic communication system, advantages of optical fiber communication, optical fiber – structure, types of fibers, dispersion, Light sources – LED, Laser diode, Light detectors – PIN diode, avalanche diode, Satellite communication, satellite orbits, application of satellites, frequency allocation.

8. Television

Basic principles of Television, principles of scanning, interlaced scanning, Bandwidth of TV transmission, Block diagram of monochrome TV revivers, color TV receiver, Television displays, satellite Television, cable TV.

9. Fundamentals of Computer

Basic block diagram of a computer, Input devices, output devices, Dot matrix printer, Non – Impact printer – laser printer, Inkjet printer, Thermal printer, memory SRAM, DRAM, floppy disk, Hard disk, optical disk, flash drive, classification of computers, mother board, computer ports, computer software, computer languages.

10. Internet Technology

Computer networking, network protocols, Network topologies, Data communication devices – network interface card, Hub, switches, Repeaters, Bridges, Routers, Gate ways, Modem, types of networks – PAN, LAN, MAN, WAN, Domain name systems and IP addresses, client – server computing, File servers.

11. Basics of Telephone Communication

Public switched Telephone network, Electronic exchange, SPC – centralized and distributed, cellular communication, cell system for frequency re – use, multiple access schemes – FDMA, TDMA, CDMA, Basic idea of GSM, GPS, GPRS

Guidelines for Higher Secondary Practical Evaluation – 2015

ELECTRONICS

We follow outcome focussed assessment approach in the evaluation process in the Kerala School Curriculum 2013. Term end evaluation is an important aspect of assessment. Along with term end evaluation at the end of the academic year, practical evaluation (PE) is to be conducted. A list of 13 experiments each are given below which are suitable for plus one and plus two classes. A minimum of 6 experiments each from the list are to be performed during both the years. Those performed by the students with a minimum of 12 experiments are to be considered for the final practical examination which will be conducted at the end of the second year of the course. Practical evaluation will be conducted in batches. The maximum number of students in each batch is limited to 15.

- Final practical examination will be of three hours and the maximum score will be 40.
- Any one question selected at random may be given to each student.
- Only 15 students will be permitted to attend the practical examination at a time.
- Students must attend the practical examination with a practical log book.
- Neatness in connecting equipment as per the circuit diagram, ability in observing the output , accuracy in measurement an ability in recording the data should be assessed.
- Calculation of data, sketching graph and recording final results should be assessed.
- The score distribution will be as follows.

1.	Theory and principle	:	9
2.	Circuit diagram	:	7
3.	Setting up of circuit	:	7

4.	Performing experiment	:	5
5.	Measurement and recording	:	6
6.	Result	:	2
7.	Ascertaining the awareness relating to the particular experiment	:	4

LIST OF PRACTICAL EXPERIMENTS

First year

1. The study of the characteristic of a PN junction- forward and reverse.(use silicon and germanium)
2. The study of forward and reverse characteristics of Zener diode (repeat the experiment for two or three diodes of different break down voltages.)
3. The input and output VI characteristics of CE configuration.
4. Study of transistor switch- switch a LED on and OFF using transistor switch.
5. Study of the characteristic of LDR – resistance variation with intensity of light.
6. Study of VI characteristic of LED
7. Light detection using photodiode and phototransistors.
8. Study of half wave rectifier- measurement of ripple factor.
9. Study of centre tap full wave rectifier- measurement of ripple factor.
10. Study of bridge type full wave rectifier- measurement of ripple factor.
11. Reduction of ripple at the output of a rectifier using simple capacitor filter- repeat experiment for different value of capacitor.
12. Voltage gain measurement of a CE amplifier.
13. Study of frequency response of CE amplifier.

Second year

14. Generation of sine wave using a RC phase shift oscillator.
15. Generation of square wave using astable multivibrator.
16. Setting up of OR, AND and NOT gates and verification of truth table.
17. Familiarization of logic gate ICs.
18. Setting up of an Ex-OR gate using basic gates and verification of truth table.
19. Implementation of half adder and full adder using logic gates.
20. Design and set up of an op-amp inverting and non inverting amplifier.
21. Study of clipping circuits- simple clipper and biased clipper- positive and negative
22. Study of clamper circuits- simple clamper and biased clamper- positive and negative.
23. Study of integrator and differentiator circuits.
24. Study of zener diode voltage regulation.
25. Familiarization of voltage regulator ICs.
26. Setting up of LPF and HPF using circuits and study of their frequency response.

LEARNING OUTCOMES

POWER SUPPLIES AND VOLTAGE STABILISERS

1.1. explains the need of regulated power supply
1.2. explains the basic principles of series and shunt voltage regulators
1.3. sketches the circuit diagrams of fixed voltage regulators
1.4. identifies various IC voltage regulators
1.5. designs and constructs a power supply

WAVESHAPING CIRCUITS

2.1. explains different types of clipping circuits.
2.2. demonstrates the working of clamping circuits.
2.3. sketches the input and output waveforms of RC differentiator and integrator.
2.4. identifies different types of RC filter circuits
2.5. explains the working of different types of filters.
2.6. sketches the circuit diagram of buffer, adder and subtractor using op-amps.
2.7. explains the working of comparator and its applications.

DIGITAL ELECTRONICS

3.1. explains the difference between combinational and sequential circuits.
3.2. demonstrates the operation of multiplexer and demultiplexer.
3.3. sketches the circuit of them.
3.4. explains the operation of encoder and decoder.
3.5. designs and set up a one bit comparator.
3.6. explains the operation of the basic flip flops.
3.7. sketches the circuit and prepares the truth table of these flip flops.
3.8. explains the operation of a counter.
3.9. sketches the circuit of a shift register with D FFs.
3.10. explains the types of shift registers.

RADIO BROADCASTING

4.1. identifies the need for modulation.
4.2. explains the concept of AM.
4.3. explains the concepts of spectrum, bandwidth and power of AM.
4.4. explains the operation of AM generator and AM demodulation.
4.5. explains FM.
4.6. sketches the spectrum of FM
4.7. describes the noise immunity of FM
4.8. compares the performance of AM and FM.
4.9. explains the operation of TRF receivers.
4.10. explains the merit of superheterodyne receiver.

COMMUNICATION SYSTEMS

5.1. explains the origin and history of development of communication system.
5.2. points out the allocation of different frequency bands.
5.3. explains the invention of radio waves and its propagation.
5.4. points out the differences between long, medium and short wave propagation.
5.5. differentiates ground wave and sky wave.
5.6. identifies the different layers of Ionosphere.
5.7. explains critical frequency and maximum usable frequency.

DATA COMMUNICATION

6.1. explains the difference between continuous modulation and pulse modulation.
6.2. describes the concept of sampling.
6.3. explains PCM and its generation.
6.4. explains the need for multiplexing.
6.5. describes the concept and difference between TDM and FDM.
6.6. demonstrates various digital modulation.
6.7. explains different modulation schemes such as ASK, FSK, and PSK

OPTICAL FIBER AND SATELLITE COMMUNICATION

7.1. Points out the advantages of optical fiber communication system
7.2. Classifies optical fibers
7.3. Explains the structure of optical fiber cable and light propagation in optical fibers
7.4. Explains the advantages of optical fiber communication
7.5. · Differentiates various types of fiber optic cables
7.6. Describes the light phenomena like reflection and refraction
7.7. Describes the features of different light sources used in optical fiber communication
7.8. Describes the block diagram of an optical communication system
7.9. Explains light detection in optical fibers
7.10. Explains the principles of satellite communication
7.11. Calculates the orbital velocity and time period of a satellite
7.12. Derives the relationship between orbital radius and time period
7.13. Points out various satellites launched by India.

TELEVISION

8.1. explains the history and development of TV systems.
8.2. explains the scanning process of television picture.
8.3. explains the bandwidth of TV transmission.
8.4. draws the block diagram and thereby explains the working of monochrome TV receiver.
8.5. identifies the basics of colour TV.
8.6. explains additive colour mixing.
8.7. explains the reception process of dish antenna.
8.8. points out the uses of co-axial cable.
8.9. explains the arrangement of cable TV network.

FUNDAMENTALS OF COMPUTERS

9.1. sketches the block diagram of a computer and explains its structure.
9.2. explains the functions of various input and output devices.

9.3. differentiates various printing technologies.
9.4. identifies various units of memory storage.
9.5. explains the characteristics of primary memory.
9.6. explains the characteristics of different secondary storage devices.
9.7. distinguishes between static and dynamic RAM.
9.8. classifies computers on the basis of speed and computing power.
9.9. explains the functions and structure of motherboard.
9.10. identifies different computer ports.
9.11. classifies computer softwares.
9.12. explains various system and application softwares.
9.13. differentiates various computer languages.

INTERNET TECHNOLOGY

10.1. explains the needs and advantages of computer networking
10.2. differentiates different network protocols
10.3. compares different data communication devices
10.4. explains the functions of MODEM
10.5. identifies different network topologies
10.6. differentiates different types of networks
10.7. identifies domain names and IP addresses
10.8. explains the concept of client/ server computing

BASICS OF TELEPHONE COMMUNICATION

11.1. explains the need of PSTN
11.2. sketches the structure of PSTN
11.3. identifies different switching offices
11.4. differentiates centralized SPC and distributed SPC
11.5. describes how cell system is a spectrum efficient system
11.6. explains the concept of frequency reuse
11.7. points out the requirements for a multiple access
11.8. differentiates TDMA,FDMA and CDMA
11.9. explains GSM
11.10. explains the working of GPS
11.11. explains GPRS technology.

SCHEME OF WORK

Chapter	Month	Chapters	Periods	Weight of Score
1	June	Power Supplies and Voltage Stabilizers	12	4
2	July	Wave shaping Circuits	20	6
3	July August	Digital Electronics	18	6
4	August September	Radio Broadcasting	16	6
5	September	Communication System	6	3
6	October	Date Communication	14	4
7	October November	Optical Fibre and Satellite Communication	22	8
8	November December	Television	20	6
9	December	Fundamentals of Computers	16	5
10	January	Internet Technologies	18	6
11	January February	Basics of Telephone Communications	18	6

UNIT 1

POWER SUPPLIES AND VOLTAGE STABILIZERS

Introduction

The dc power for electronic circuits is obtained from 230 V ac lines by using rectifier- filter system. The dc voltage from a rectifier filter system should remain constant irrespective of the changes in ac mains or load. To make the dc voltage constant, regulating devices are used. A power supply including voltage regulator circuit is called a regulated dc power supply.

'The need for regulated power supplies' is to be transacted through assembling and demonstration of an ordinary power supply followed by a general discussion. Using the block diagram of a regulated power supply,its structure and the methods of connection are to be transacted to the students. The working of a zener diode regular, transistor series voltage regulator, fixed and adjustable IC voltage regulators are to be explained to the learners using demonstration of assembled circuits, circuit diagrams and general discussions. A typical DC regulated power supply design should be transacted by instructing them to assemble a regulated power supply.

The assessment methods, include the participation in discussions, skill in assembling circuits involvement in collecting and demonstrating components and skill in circuit design.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Need for regulated power supply • Imaging • Comparing	• Assembling and demonstration of an ordinary power supply • Discussion on the need for regulation	• Explains the need for regulated power supply.
Regulated power supply • Sketching • Illustrating	• Discussion on how and where to connect the regulator • Demonstration of a block diagram of a regulated power supply	• Explains the need for regulated power supply.
Zener diode voltage regulator • Analysing • Circuit assembling	• Discussion on Zener voltage regulation • Demonstrating the assembled circuit	• Explains the principles of series and shunt voltage regulators.
	Participation in discussion Skill in assembling circuits Involvement in collecting and demonstrating components	
Transistor series voltage regulator. • Communicating • Experimenting	• Discussion on transistor series voltage regulator. • Demonstrating the assembled circuit	• Explains the principles of series and shunt voltage regulators
Fixed voltage regulators • Illustrating • Comparing	• Demonstration of certain fixed IC regulators • Demonstration of the circuit diagrams of fixed IC regulators	• Sketches the circuit diagrams of fixed voltage regulators.
Adjustable voltage regulators Illustrating Comparing	• Demonstration of various adjustable voltage regulators. • Demonstration of the circuit diagrams of fixed IC regulators.	• Identifies various IC voltage regulators.
Typical DC regulated power supply design. • Analysing • Designing	• Designing a DC regulated power supply. • Assembling a DC regulated power supply.	• Designs and constructs a power supply.

Suggested Activity 1.1

- Assembling and demonstration
- General discussion

Using your school Electronics laboratory provide transformers, diodes, resistors capacitors and connecting wires as needed and ask the students to assemble an ordinary power supply. Students may be permitted to verify the output of their circuits using C.R.O.

Now a discussion many be conducted on the need for a d c power supply using the following discussion points.

Discussion Points

- What are the situations where low voltage dc supplies are needed?
- How can we obtain low voltage DC from the AC mains?
- What is the need of a filter?
- Is the output from such an ordinary DC supply always constant?
- If not so, why?
- Why a zener diode can be used as a voltage regulator?

Now the teacher may consolidate the need for regulated power supply

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
General discussion	Activity logbook	Unit test
Assembling circuits	Worksheet	
Data collection Demonstration		

Worksheet

1. Regulation against the variations in input ac supply is called……………..(Line regulation)
2. Example for a variable I C Voltage regulator is ……………………………(LM 337)
3. IC 7805 has………………..output voltage. (+5V)
4. The name of fixed voltage regulator IC which gives an output voltage of 12V DC is ……………(7812)
5. The percentage load regulation is given by the equation……………………… $\left(\frac{VNL - VFL}{VFL}\right) \times 100$

TE Questions

1. (a) An unregulated power supply does not contain

   (a) Rectifier (b) filter (c) Zener diode (d) transformer (zener diod)

   (b) Draw the circuit diagram of an un regulated power supply.

   (c) How will the output voltage of this power supply be affected by the variations in the input AC supply.

2. (a) Draw the block diagram of a regulated power supply

   (b) Explain each block

3. (a) Zener regulator is a

   (i) Series regulator

   (ii) Shunt regulator

   (iii) IC regulator

   (iv) None of these (shunt regulator)

   (b) Draw and explain the circuit diagram of a power supply using a zener diode reulater

4. (a) IC 7812 has …………….output voltage (+12V)

   (b) Draw the circuit arrangement of IC 7812

5. (a) What is meant by regulation?

   (b) Explain the terms line regulation and load regulation.

Reference

1. Principles of Electronics	-	V.K. Metha and Rohit Metha, Schand Publishing
2. Electronic Principles	-	Malvino, PHI
3. Basic Electronics	-	Sadasiva Biswal
4. Electrical and Electronic Principles and Technology	-	John Bird

Unit - 2

WAVESHAPING CIRCUITS

Introduction

Waveshaping circuits are quite often used in signal processing in which signals of one form are required to be converted into other forms. Resistors, capacitors, inductors and diodes are used for waveshaping. Clipping, clamping, differentiation and integration are examples of waveshaping. In this chapter we discuss above operation with simple RC networks as well as with op-amp circuits. We use general discussion, mathematical derivations, chart making and experimental setup to transact the content.

Unit frame

Concept/Process Skills	Process/Activities with Assessment	Learning outcomes
Clipping and different types of clipping. • Communicating • Experimenting • Observing	General discussion Demonstration of the circuits Analysis of the waveform on CRO ***Assessment*** • Involvement in general discussion • Skill in circuit making	Explains different types of clipping circuits
Different types of clamping • Communicating • Experimenting • Interpreting	• General discussion on clamping • ICT simulation of different types of clamping • Circuit implementation and observation of the output. ***Assessment*** • Skill in circuit making • Involvement in discussion	Demonstrates the working of clamping circuits.
Principle of differentiating and integrating circuits. • Analysing • Observing • Interpreting	• Discussion • Mathematical derivation • Experimental set up • Observing output on CRO • Sketching waveforms ***Assessment*** • Involvement in experimenting • Quality of the prepared chart • Skill in practical experimenting	Explains RC differentiator and integrator.
Filter circuits and their classification • Observing • Comparing • Experimenting	• General discussion • Preparation of chart on types of filters • Sketching frequency response of ideal and practical filters. • Setting up simple filter circuits and draw their frequency response. ***Assessment*** • Quality of the sketches • Skill in experimenting • Participation in discussion	Identifies different types of RC filter circuits.
Various op-amp circuits • Communicating • Observing • Sketching • Measuring	• General discussion • Sketching circuit diagram • Circuit implementation and output verification ***Assessment*** • Correctness of the circuit diagram • Skill in implementing practical circuit	Sketches the circuit diagrams and explains the operation of buffer, adder and sub tractor.

Clamping circuits

Suggested activity 2.1

Experimental set up and general discussion.

Discussion points

- What is the average value of a sine wave?
- What happens to the average value when a DC voltage is added to this signal?
- What happens to this signal when polarity of the DC voltage is changed?
- Can we use a capacitor as a DC voltage source?

Now set up a clamper circuit and observe its output on a CRO. Ask the students to press AC/DC switch of the CRO and see the variation in the output. In AC position, clamping can't be observed as the added DC in the output is removed by the CRO.

Then set up a biased clamper by connecting a DC voltage source to the circuit and observe the level shift in the output signals as the value of this voltage source is varied.

Finally the teacher consolidates that the clamping is done by adding a dc voltage of required polarity and value to the signal.

Worksheet I

- Match the following

Circuit		**Function**
A) Differentiator	1)	Selects a particular frequency
B) Integrator	2)	Impedance matching
C) Buffer	3)	Converts square wave into triangular wave
D) Clamper	4)	Converts square wave into spikes
E) Filter	5)	Shifts the average of a signal up or down

(Key: A – 4, B -3, C - 2, D – 5, E – 1)

Worksheet II

- Draw the output waveform for the following circuit for a square wave input.

a) Integrator
b) Differentiator
c) Buffer
d) Positive clamper
e) Combinational clipper with Zero bias.

Repository of C.E Items

Process Assessment	Portfolio Assessment	Unit based Assessment
General discussion	Activity logbook	Unit test
Making charts	Practical evaluation	
Experimentation		

Sample TE Questions

1. A Clipper is equivalent to
   a) Buffer b) Rectifier c) Clamper d) Integrator (Ans: Rectifier)
2. In a clamper circuit, the capacitor used is of
   a) Small value b) large value c) any value (large value)
3. In an integrator circuit, relatively ……………… value capacitor is used

   a) Small b) large c) any (large)

4. The operation of which of the following circuit is frequency dependant?
   a) Buffer b) Clipper c) clamper d) Differentiator (Differentiator)
5. An integrator is a RC circuit whose output is the integral of the input.
   a) Show mathematically that the output of the integrator is the integral of the input
   b) What condition should be satisfied for the circuit perform better integration?
6. In a buffer circuit, output voltage follows the input voltage.
   a) What is the voltage gain of a buffer?
   b) Give one application of buffer.
7. An analog comparator compares two voltages given to its inputs.
   a) Draw a comparator circuit for which a sine wave of 5V (p-p) is given to positive input and a 2V DC is given to the negative input.

b) Draw the output waveform in this case.

8 Filters are classified based on the pass band they allow.

a) Identify different types of filters.

b) Draw their ideal frequency response.

c) How will you find out the cut off frequency of a filter from its frequency response?

d) Suppose you have a signal with frequencies ranging from 0Hz to 25 kHz . You are required to filter out the following bands from the above signal.

(i) 0 – 5 kHz (ii) 8 kHz – 12 kHz (iii) 5 kHz – 25 kHz

What type of filters will you choose in each of the above case and mention their cut off frequencies.

PE Items

1) Set up different types of clippers and observe their output values.
2) Implement integrator and differentiator circuits and observe output when frequency of the input signal is varied.
3) Design and implement LPF and HPF for a given cut-off frequency and draw their frequency response curve. Calculate the cut off frequency from this graph and verify it by calculating cut off frequency using equation.

Reference

1. Principles of Electronics	-	V.K. Metha, 3rd Edition
2. Linear Integrated circuits	-	A.P Godse, A.V, Bakshi
3. Op-amps and Linear Integrated circuits	-	Ramakant. A Gayakwad, PHI
4. Linear Integrated circuits	-	D. Roy Choudhari

Unit 3

DIGITAL ELECTRONICS

Introduction

Digital systems are spreading everywhere in the field of electronics. The digital circuits can be classified into combinational circuits and sequential circuits. The sequential circuits are having memory. The logic gates are the basic building units of the digital circuits. With these gates adder, subtractor, encoder, decoder flip-flops, shift registers, counters etc. are designed. The circuit diagram of each of these circuits is sketched and they are assembled in the laboratory and their operation is observed. The truth table of various flip flops is verified. The students may be asked to draw the logic circuit for a given digital logic. ICT can be used to obtain the working simulations of the above digital circuits.

Unit Frame

Concept/Process Skills	Process/Activities with Assessment	Learning outcomes
Combinational and sequential circuits. • Communicating • Interpreting • Organizing • Distinguishing	• General discussion • Chart preparation identifying combinational and sequential circuits. • Preparation of table citing examples for combinational and sequential circuits. ***Assessment*** • Content and quality of the chart and table. • Participation in the discussion • Correctness of the table prepared.	Explains the difference between combinational and sequential circuits.
Multiplexer and de multiplexer. • Analyzing • Sketching • communicating	• General discussion on multiplexing and demultiplexing. • Sketching their circuits and explaining the operation. • Identifying their application areas. ***Assessment*** • Points of discussion • Involvement in activities	Demonstrates the operation of multiplexer and demultiplexer
Comparator and its application. • Communicating • Reasoning • Organising	• Discussion on the need of comparator. • Drawing and explaining the circuit of one bit comparator. • Discussion on expanding one bit to two –bit comparator.	Designs and sets one bit comparator
Flip flops and their types • Interpreting • Analysing • Communicating	• General discussion on flip flops and their types. • Sketching the circuit diagram of each. • Group discussion and presentation of their operation. • Verifying the truth table • Discussion on the application	Explains the operation of basic flip flops.
Operation of counter and shift register. • Analysing • Reasoning • Sketching •	• Discussion on the need of a counter and shift register • Sketching the circuit diagram and explains the operation. • Develop and draw the output waveform of a counter	Explains the operation of counters and shift register

Counter Circuits

Suggested Activity 3.1

Discussion Points:

- How an event or thing can be counted electronically?
- Why it is to be converted into electrical pulses?
- T-flip flops can be arranged to form a counter.
- The change of state of T-flip flops can be used to represent a binary count.

A 3 stage asynchronous binary counter is formed using three T-flip -flops. Ask the students to record the state (HIGH or LOW) of output of each flip flop when a clock pulse is given as input. Repeat this for successive clock pulses. Prepare a table to show the number of clock pulses and output of each flip flop (As given in the textbook). Now observe that each output state is the binary equivalent of the number of clock pulses then applied. The automatic resetting of the counter can also be verified for the eighth clock pulse.

Then draw a four stage counter and find out the state of each flip flop for successive clock pulses. A table mentioned in the previous case can be developed here for the 4 bit counter.

The teacher finally consolidates the operation of the counter and mentions various applications of it. The student may be asked to find out situations around them where a counter can be used.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
Drawing circuit diagrams	Activity logbook	Unit test
Experimentation	Worksheet	

TE Questions

1. It is said that S = R = 1 input is invalid in a SR flip flop

a) Why it is called invalid?

b) Draw a SR flip flop using NOR gates.

c) Write the truth table of SR flip flop

d) How this invalid input problem is overcome?

2. D and T flip flops are the modifications of JK flip flop

a) Draw D and T flip flops using JK flip flop

b) Write their truth table

c) How they got their name?

3. A counter circuit is used to count any event or thing electronically.

a) Which flip flop is used as the building block of the counter?

b) Draw a 3 stage counter circuit and explain its operation.

c) Design a decade counter using four T- flip flops.

4. A shit register can store data bits and the bits can be shifted left or right to perform numerical operations.

a) Draw a 8 – bit SISO shift register.

b) Explain the Write/Read operation of this register.

1. **Fill in the blanks**

Flip flop	Application
T flip flop	
	Shift register
	Latch

2. **Match the following**

SR flip flop	Master – Slave configuration
D flip flop	Toggling output
T flip flop	Forbidden state
JK flip flop	One clock pulse delay

3. A multiplexer is used to save the number of data lines required for communication.
   a) Draw the circuit of a 4 : 1 multiplexer using gates.
   b) How will you set up a 8 : 1 multiplexer using two 4 : 1 multiplexers?
4. Draw the circuit of a 3 to 8 decoder.
5. A digital comparator is used to compare two binary numbers.
   a) Draw the circuit of a one bit comparator.
   b) Which gate is used to say that the bits are equal?
6. The sequential circuits are made up of flip flops.
   a) What do you mean by a sequential circuit?

b) Flip flop is a one – bit memory. Why do you think so?

c) What are the different types of flip flops?

PE ITEMS

1) Familiarizes with 4 : 1 and 8 : 1 multiplexer ICs.
2) Familiarise with SR, JK flip flops and counter and shift register ICs.

Reference

1. Digital Fundamentals - Thomas .L. Floyd, Universal Book stall.
2. Modern Digital Electronics - R.P. Jain, MC Graw Hill.
3. Digital Electronics Principles, Devices and Application - Anil K. Mani
4. Fundamentals of Digital circuits- A Anand kumar PHI

Unit : 4

RADIO BROADCASTING

Introduction

The radio signals are broad cast to distant locations using antennas. A low frequency message signal cannot be transmitted with a feasible size antenna. To solve this problem modulation technique is used in which the low frequency message signal is added to a high frequency carrier signal. This modulated high frequency signal is then transmitted using antenna with a practically feasible size. According to the parameter which is varied to include the message we have basically three types of modulation schemes. They are AM, FM and PM. The waveforms of AM and FM are sketched. The AM signal for different modulation index may also be sketched. A seminar can be conducted on AM and FM and a comparison between them is conducted citing merits and demerits. The TRF receiver and super heterodyne receiver are discussed in groups and the advantages of super heterodyne receiver is established.

Unit Frame

Concept/Process Skills	Process/Activities with Assessment	Learning outcomes
Need for modulation • Calculating • Reasoning • Communicating	• General discussion • Mathematical calculation of antenna length for different frequencies • Pictorial representation of frequency division multiplexing **Assessment** 1) Involvement in discussion 2) Quality of the chart 3) Skill for mathematical calculation.	Identifies the need modulation.
AM and FM • Reasoning • Organizing • Sketching	• General discussion • Graphical representation of AM and FM signals • Seminar on AM and FM • Mathematical calculation of power of AM signal	Explains the concept of AM and FM
Comparison of AM and FM • Communicating • Reasoning	• Group discussion • Chart preparation	Compares the performance of AM and FM
TRF receiver • Communicating • Reasoning	• General discussion • Group discussion **Assessment** 1. Participation in discussion 2. Quality of the talk.	Explains the operation of TRF receiver.
Principle of super heterodyne receiver • Explaining • Organizing • Communicating	• Sketching block diagram • Calculation of IF frequency and image frequency. • Seminar on the working of this receiver. **Assessment** 1. Presentation skill 2. Mathematical skill.	Explains the operation and merits of super heterodyne receiver.

Amplitude Modulation

Suggested Activity 4.1

Discussion and Simulation using ICT

Discussion points

1. Can we vary the amplitude of a signal in accordance with voltage variation of another signal?
2. What happens to the amplitude variation of the carrier signal when amplitude of the message is varied?
3. How can we measure the strength of modulation?
4. What happens to the AM signal when modulation index exceeds unity?
5. How many different frequency terms are there in the mathematical expression of the AM signal?

An AM signal can be observed using ICT simulation and vary the amplitude of the message signal. The strength of modulation of AM signal can be seen varying. When Vm exceeds Vc , it is seen that the message added in the carrier gets distorted. The method of calculating modulation index can be done by viewing the AM signal and by noting down the maximum voltage and minimum voltage, using a CRO.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
General discussion	Activity logbook	Unit test
Group discussion	Seminar	

I. Fill in the blanks with AM or FM

1. Modulation index greater than one : …. .. … . . . .
2. Modulation index less than one : …. .. … . . . .
3. Small band width : …. .. … . . . .
4. Large band width : …. .. … . . . .

5. High frequency carrier : …. .. … . . . .
6. Small frequency carrier : …. .. … . . . .
7. Better noise immunity : …. .. … . . . .
8. Poor noise immunity : …. .. … . . . .
9. Large operating range : …. .. … . . . .
10. Small operating range : …. .. … . . . .

II. Match the following

a) DSB - Improved spectrum efficiency
b) SSB - used in TV transmission
c) VSB - Maximum bandwidth
d) ISB - Minimum bandwidth

III. Modulation is an inevitable process in radio communication

a) Write three types of modulation.
b) Discuss three needs for modulation.
c) Calculate the length of the antenna to effectively radiate 10KHz signal and 100MHz signal.
d) Frequency translation is the result of modulation. What you mean by frequency translation?

IV. Modulation index determines the strength of modulation.

a) Draw AM signal for $m<1$, $m = 1$, and $m>1$.
b) Discuss the problem when 'm' exceeds unity.
c) How will you calculate modulation index by observing an AM signal?

V. In the spectrum of AM, the number of spectral lines depends on the number of frequency components contained in the message.

a) Find the number of spectral lines in AM signal if the message contains five different frequencies.
b) If the highest frequency in the message is 10KHz, calculate the bandwidth of the AM signal.
c) A carrier signal $10\sin 2\pi \times 10^5 t$ is modulated with a message $5\sin 2\pi \times 10^3 t$ Draw the complete frequency spectrum.

VI. AM demodulation is a simple process in which a low pass filter can separate the message signal from the carrier.

a) Draw the block diagram of an AM demodulation.

b) Why rectification is done before filtering?

VII. Based on the size of bandwidth AM can be classified into different types.

a) Name these types of AM.

b) Compare them based on relative merits and demerits.

VIII. Super heterodyne receiver is widely used in radio receivers.

a) Discuss the drawbacks of TRF receiver.

b) What is image frequency?

c) Discuss the advantage of super heterodyne receiver.

d) Draw the block diagram of a super heterodyne receiver.

Reference

1. Principles of Communication System - George Kennedy
2. Electronic communication System - Kennedy, Davis
3. Modern Analog and Digital communication - B.P. Lathi
4. Principles of Communication - Taub and schilling

Unit – 5

COMMUNICATION SYSTEM

Introduction

The evaluation of communication technology changed the way of human life drastically. Communication started from using fire and drums in the B.Cs and reached at the 4G communication standards now. The technology changed the distance of communication from a few metres to several thousand kilometres, communication in a room to communication in outer space.

The basic idea of communication may be explained with the help of a block diagram. A group discussion can be conducted subjecting the role of each block. In order to transact the different frequency bunds used for communication, a table is prepared. A seminar may be conducted to make the idea of different types of propagation of radio waves clear to the students.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Frequency bands for communication • Creating • Organizing • Communicating	• Chart preparation showing allocation of different frequency bands. • Data collection on the application of different frequency bands. • General discussion. **Assessment** 1. Quality of the data collected 2. Content of the chart 3. Ability to express the idea.	• Points out the allocation of different frequency bands.
Types of propagation of radio waves. • Reasoning. • Communicating	• General discussion • Seminar presentation • Presentation skill **Assessment** 1. Presentation skill 2. Participation in discussion	• Explains different types of propagation of radio waves.
Ionospheric layers, critical frequency and maximum usable frequency.	• Pictorial demonstration of critical frequency and maximum usable frequency. • Group discussion • Seminar **Assessment** 1. Presentation skill 2. Quality and content of the pictorial demonstration	• Explain critical frequency, maximum usable frequency and various ionospheric layers.

Basic Communication System

Suggested Activity 5.1

- General discussion
- Experiment

Discussion Points

- What is the need of technology in communication ?
- Why should we convert a voice signal into electric signal in long distance communication?
- What are the problem with wired communication?
- What are the functions of antenna in communication?

- What is the function of a repeater?

Find out various areas where some type of communication is used. The examples are TV, Radio, Mobile phone, Radar etc. Try to expand this list. Then find out the frequencies used for such communication.

Using the public address system in your school, try the following experiment.

Use a separate long wire (say 100m) to connect between the microphone and amplifier. Then connect this wire between amplifier and loudspeaker. Note whether there is any difference in these two situations.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
Drawing block diagram	Activity logbook	Seminar
Group discussion	Worksheet	

TE questions

1. The communication in different fields uses different frequencies.
   (a) Prepare a table showing different frequency bands used in communication.
   (b) Find the frequency ranges used for mobile communication and satellite TV transmission.
   (c) Give the frequency range used for AM and FM radio transmission.
2. Ionosphere has a major role in communication.
   (a) What you mean by ionization density?
   (b) What is night effect?
   (c) What is critical frequency? How it is connected with ionization density?
3. Critical frequency and MUF are two terms associated with ionospheric communication.
   (a) Differentiate between them.
   (b) Write the relationship between them.
   (c) A signal is projected at an angle of 30^0 towards an ionospheric layer with critical frequency 10 MHz. Find out the maximum usable frequency.

Worksheet

Frequency band	**Name**	**Typical uses**
1. 3 -30 KHz	…………………………..	Submarine communication
2. …………………..	MF	…………………………………….
3. ……………………	…………………………….	FM radio broadcasting
4. …………………...	SHF	……………………………………..

Reference

1. Principle of Communication system - George Kennedy
2. Principle of Communication - Taub and schilling
3. Modern Analog and digital communication system – B.P. Lathi

Unit – 6

DATA COMMUNICATION

Introduction

We know that computer is a digital device and communication happens between a computer and its peripheral devices. In this communication digital data flows between them. When an analog signal is to be processed with a computer, it should be first converted into samples and then these samples are encoded into digital signals. When we handle data in the form of digital, it can be easily stored, processed as well as transmitted. In digital communication, noise added to the data can be removed and error caused if any in the data can be detected and corrected. Also the digital data can be converted back to the analog form with minimal error.

The concept of sampling can be demonstrated with the help of diagram. The PCM is a widely used digital transmission technique and its block diagram may be discussed giving emphasis to each block. The process of quantisation and quantisation error can be explained with the help of a numerical example.

The two widely used multiplexing schemes TDM and FDM can be demonstrated with block diagram and typical examples.

For log distance transmission and wireless transmission of digital data, digital modulation techniques such as ASK, FSK, PSK and their modified versions are used. A pictorial demonstration and group discussion may be conducted in this topic.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Continuous modulation and pulse modulation. • Organising • Data collecting • Communicating	• Preparation of table of comparison • Comparison of merits and demerits. • General discussion **Assessment** 1. Content of the table 2. Ability of expressing idea.	• Explains the difference between continuous modulation and pulse modulation.
PCM • Communicating • Drawing • Explaining	• Preparation of block diagram. • Group discussion on each block • Seminar **Assessment** 1. Quality of the block diagram. 2. Participation in group discussion.	• Explains PCM
Multiplexing • Creating • Recongnising	• General discussion • Pictorisation of multiplexing	• Explains the need for multiplexing.
TDM and FDM • Communicating • reasoning	• Pictorial demonstration • Preparation of comparison table. • Demonstration with a practical example. • Group discussion. **Assessment** 1. Quality of the table 2. Practical skill.	• Describes the concept and difference between TDM and FDM.
Digital modulation techniques. • Comparing • Reasoning • Communicating	• Pictorial demonstration of modulation schemes. • Comparison table on merits and demerits. • General discussion. **Assessment** 1. Quality of the demonstration 2. Participation in discussion	• Explains different modulation schemes such as ASK, FSK, and PSK.

Suggested Activity 6. 1

Multiplexing

- General discussion
- Demonstration with an example.

Discussion points

1. When there are multiple number of messages, how many different channels are required?
2. How can we reduce the number of channels in this case?
3. What are the types of multiplexing?
4. How can we divide time and incorporate multiple messages along the same channel?
5. How can we divide the band width of a channel to accommodate multiple signals in the same channel?
6. What are the merits and demerits of TDM and FDM?

Demonstration

Considering five different messages, set up a TDM scheme. Draw the illustrating diagram. The five messages are transmitted in their particular time slot along the channel. One message gets T/5 seconds. These packets of messages are then combined at the receiver. The whole process can also be explained with the help of a simulation video using ICT.

The operation of FDM can also be illustrated with a practical example. Use different carrier frequencies and modulate them with the five messages. They can be transmitted along a channel with enough bandwidth. They are separated at the receiver using band pass filters. ICT simulation can be used to give a better understanding to the students.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
General discussion	Activity logbook	Unit test
Sketching diagram	Worksheet	

TE questions

1. Fill in the blanks with TDM or FDM
   (a) Large band width required. …………………………………………..(FDM)
   (b) Band pass filters are required…………………………………………(FDM)

(c) More time is required ……………………………………………………(TDM)

(d) Small bandwidth is required …………………………………………(TDM)

2. A continuous signal can be obtained from its samples.
   (a) What is the minimum rate of sampling?
   (b) Discuss the merits and demerits of using sampling rate more than minimum rate.
3. One of the main block in PCM is quantization.
   (a) What is the need of quantization?
   (b) Discuss the reason for quantization error.
4. Multiplexing saves the no. of channels required for communication.
   (a) What are the two widely used multiplexing schemes?
   (b) Set up a FDM scheme to transmit three different messages of each with O – 10 KH_z band.(Hint: Choose carriers of suitable frequency)
   (c) Discuss the merits and demerits of TDM.
   (d) Compare TDM and FDM.
   (e) Give examples where TDM and FDM are used.
5. Write the difference between FM signal and FSK signal.

   Draw both these signals
6. Discuss the merits of FSK over ASK.
7. A FSK scheme can be extended to transmit more number of bits at a time.
   (a) What is the name of such a scheme?
   (b) How many different frequencies are required to transmit three bits at a time?

Reference

1. Principles of Communication System - George Kennedy

2. Electronic communication System - Kennedy, Davis

3. Modern Analog and Digital communication - B.P. Lathi

4. Principles of Communication - Taub and schilling

Unit – 7

OPTICAL FIBER AND SATELLITE COMMUNICATION

Introduction

Now a days large amount of data is transmitted over channels. We use internet and sounds, videos, images etc. are being transmitted over it. If we want o send them very fast, then the channels should have large band width. The band width of coaxial cables and other electrical carriers is limited. Optical fibers which have enormously large band width are replacing the old communication channels. Also for large distance communication we use satellite technology. This chapter deals with optical fiber and satellite communication.

A general discussion may be carried out to elucidate the advantages of optical fiber communication.

The concept of total internal reflection can be explained with ray diagram and ICT simulation. The concept of different light sources and detectors are transacted through group discussion.

The concept of satellites and their application are transacted through general discussion and group discussion.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Advantages of optical fiber communication. • Organizing • Communicating	• Chart preparation • Group discussion • Data collection **Assessment** 1. Quality of the chart 2. Participation in group discussion. 3. Quality of the data.	• Points out advantages of optical fiber communication.
Structure of optical fiber and light propagation. • Organising • Drawing • Data collecting	• Picturisation • ICT simulation • Optical ray diagram. **Assessment** 1. Quality of the diagrams.	• Explains the structure of optical fiber and light propagation in it.
Light sources and detectors used in optical communication. • Data collecting • Communicating • comparing	• Data collection of different sources and detectors. • Seminar • Group discussion. • Performance comparison **Assessment** 1. Quality of the data 2. Quality of the seminar report 3. Participation in discussion.	• Describes the features of different light sources and light detectors.
Principle of satellite communication • Data collecting • Organizing • Communicating	• General discussion on the need of satellites. • Data collection on satellites launched by India. • Mathematical derivation of velocity of satellites. • Group discussion on application of satellites. **Assessment** 1. Quality of the data collected. 2. Participation in group discussion.	• Explains the principle of satellite communication.

Suggested Activity 7.1

Optical fiber communication system

General discussion and experimenting

Discussion points

- What are the problems with electrical communication media?
- How can we convert electrical signals into light signals?
- How light can be transmitted through bended paths?
- What are the advantages of optical fiber communication?

Using LED, optical fiber. and LDR we can set up a basic communication system. Generate electrical pulses using a multivibrator circuit and give these pulses to an LED which is fixed to the fiber at one end and use a LDR circuit to detect light at the other end. The pulse current generated is converted into pulse voltage and it can be seen using a CRO.

We can also transmit music using this set up. The signal from an audio player is given to the LED and the electric signal generated by the LDR is amplified and heard using loudspeaker. Instead of LDR, photo diode or photo transistor can be used. Also instead of LED as light source, laser diode can be used.

Repository of C.E Items

Process Assessment	Portfolio Assessment	Unit based Assessment
General discussion	Activity log book	Unit test
Group discussion	Worksheet	

TE questions

1. The following components are required for optical fiber communication. Arrange them in the order of placement in communication.(Photodiode, fiber, LED, Amplifier, Loudspeaker, Microphone)
2. Match the following

	A	B
a)	LED `	1) Variable resistor
b)	Optical fiber	2 Light source
c)	Photo diode	3) Total internal reflection
d)	LDR	4) light detector

(Ans: a – 2, b – 3, c – 4, d – 1)

3. Optical fiber is replacing the conventional electrical cables almost every where.

(a) Discuss the main advantages of optical fiber communication.

b) The speed of data transmission is high in optical fiber. Give an explanation based on the large bandwidth of the fiber.

c) The number of repeaters required in optical fiber communication is less. Why?

4. We know that light propagates along a straight line. But light propagates through bent optical fiber.

(a) How will you explain this?

(b) Write the condition on the refractive index of the core and cladding.

(c) How total internal reflection is utilised in optical fiber?

5. The loss of signals when propagated through fiber is very small.

(a) What are the main causes of signal loss in optical fibers?

(b) compare the losses in coaxial cable and optical fiber

6. Write the two conditions for total internal reflection to take place.

7. There are three basic types of fiber optic cables used in communication systems.

a) Name these three types.

b) Draw the light propagation through them.

c) What are the constructional difference in them?

d) Compare and contrast the performance of these three fibers.

8. Satellite acts as a repeater in long distance communication.

a) Explain the following terms associated with satellite communication

i) Uplink (ii) down link (iii) foot print

b) Discuss the various fields of application of satellites.

c) Discuss the disadvantages of satellite communication compared to fiber optic communication.

Reference

1. Satellite Communication - Roody and Colin
2. Fundamentals of Satellite Communication - K. N Raja Rao
3. An introduction to Satellite Communication - D.I. Dalgleish

Unit : 8

TELEVISION

Introduction

Television (TV) is a telecommunication medium that is used for transmitting and receiving moving images and sound. Television can transmit images that are monochrome (black and white), color, or in three dimensions. In the absence of any international standard, three monochrome system grew independently. These are the 525 line line American, the 625 line European and the 819 line French Systems. In India, where television transmission started in 1959, the 625 line monochrome system was adopted. The three different standards of black and white television have resulted in the development of three different systems of colour television compatible respectively with the three monochromatic systems these systems were NTSC, PAL and SECAM Systems. In India the system. In this unit different aspects of monochromatic and colour television technologies, satellite television and cable TV networks are discussed in detail.

The contents of this unit should be transacted to the students through general discussion diagram sketching and demonstration using ICT. The methods of assessment include the participation of the student in general discussion, efficiency in data collection, ability to sketch diagrams and the ability to demonstrate and explain.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Basic principles of TV • Imaging • Sketching • Communicating	• Discussion on the history and development of TV systems. • Discussion on the basic principle of TV.	• Explains the history and development of TV system.
Principles of scanning • Communicating • Analysing	• Discussion on scanning and interlaced scanning • Sketching diagrams of interlaced scanning	• Explains the scanning process of TV systems
Bandaridth of TV transmission • Imaging • Analysing	• Discussion on the bandwidth of TV transmission • Sketching the spectrum of a TV channel	• Explains the BW of TV transmission.
Block diagram of a monochromatic TV receiver. Sketching Communicating	• Sketching the block diagram of a monochromatic TV receiver. • Discussion on each block in the diagram	• Draws the block diagram and thereby explains the working of a monochromtic TV receiver.
Concept of colour TV receiver Sketching Communicating	• Sketching the diagram showing the mixing of primary colours. • Discussion on the basics of colour TV.	• Identifies the basics of colour TV. • Explains additive colour mixing.
Luminance, Hue and saturation • Communicating • Creating	• Demonstrating a computer screen to show the effect of variance of luminance hue and saturation. • Discussion on luminance, hue and saturation.	• Explains additive colour mixing.
	Assessment • Participation in discussion • Efficiency in data collection • Ability to sketch diagrams	
Satellite Televion Imaging Analysing	• Discussion on TV signal distribution via communication satellite. • Demonstrating the sketches of satellite dish antenna.	• Explains the reception process of dish antenna.
Uses of co-axial cable. Sketching Comparing	• Sketching the cross sectional diagram of coaxial cable • Demonstrating coaxial cable. • Discussion on the uses of coaxial cables.	• Points out the uses of coaxial cables.
Cable TV network Communicating Imagining Sketching	• Discussion on the arrangement of cable TV network. • Sketching the structure of a cable TV network.	• Explains the arrangement of cable TV network.
	Assessment • Participation in discussion • Ability in demonstrating and explaining • Quality of sketches drawn	

Principles of Scanning

Suggested Activity 8.1

- General discussion
- Sketching diagrams

After introducing the concept of scanning to the students a general discussion is to be conducted based on the following points.

- What is meant by scanning?
- What is meant by a picture frame ?
- Doses slow scanning rate affect the picture transmission?
- How can the scanning rate be optimized?

After general discussion, students are advised to sketch the diagrams (graph) of interlaced scanning method. Now the teacher may consolidate the principles of scanning.

Repository of C.E

Worksheet

Match the following

Blue + Green	-	Yellow
Red + Green	-	Cyan
Red + Blue	-	Magenta

Repository of C.E Items

Process Assessment	*Portfolio Assessment*	**Unit based Assessment**
General discussion	*Activity log book*	Unit test
Sketching block diagrams	*Worksheet*	

T.E. Questions

1.(a) In television scanning the combination of two fields is called………….. (Vertical trace, Horizontal trace, frame, retrace) (Ans: Frame)

(b) Give the significance of interlaced – scanning

2. (a) The colour system for TV used in India is (PAL, SECAM, NTSC, None of these) Ans: PAL

(b) Explain the additive colour mixing using suitable diagram

3. (a) What are the three characteristics which specify the visual information of any colour?

(b) Explain these characteristics.

4. (a) Which kind of cable is used for dish antenna to connect with TV?

(b) Explain the parts of a Co-axial cable.

Reference

1. Monochrome and colour television - R.R Gulati
2. Modern Television Practice - R.R gulati

Unit : 9

FUNDAMENTALS OF COMPUTERS

Introduction

A Computer is a fast and accurate electronic machine which stores data, processes it and produces output results under the direction of stored program of instructions. In every field of life such as education, business, entertainment, communication, instrumentation, medical field, defence etc. computers find wide spread applications. Information sharing through networking of computers provided us a lot of facilities such as internet, e-mail, social networking sites and so on. This unit describes more on computer hardware, software and networking of computers.

The contents of this unit should be transacted to the students through sketching block diagrams, general discussion, demonstration of various devices and preparation of comparison charts as described in the unit frame. The classroom assessment of students may be done on the basis of participation is general discussion, involvement in collecting components and demonstrating them quality of diagram sketched and the content and quality of chart prepared.

Unit Frame

Concept/Process skills	Process/Activities with assessment	Learning Outcomes
Basic block diagram of a computer. • Sketching • Illustrating	• Sketching the block diagram of digital computer • Discussion on each block of the diagram.	Sketches the block diagram of a computer and explains its structure.
Functions of the input devices of a computer • Sketching • Illustrating	• Demonstration of various input devices. • Discussion on the functions of each input device.	Explains the functions of various input and output devices.
Functions of the output devices of a computer • Sketching • Illustrating	• Demonstration of various output devices. • Discussion on the functions of each output device.	Explains the functions of various input and output devices.
Different printing technologies • Comparing • Communicating	• Discussion on different printing technologies • Demonstration of certain printers.	• Differentiates various printing technologies.
Classification and functions of different computer memories. • Classifying • Comparing • Communicating	• Discussion on different computer memories. • Demonstration of memories such as RAM, Hard Disk etc.	• Identifies various units of memory storage.
	Assessment • Participation in discussion • Involvement in collecting components and demonstrating them • Quality of diagram sketched.	
Characteristics of primary memory. • Comparing • Communicating	• Discussion on the characteristics of primary memory.	• Explains the characteristics of primary memory.
Characteristics of secondary memory. Comparing Communicating	Demonstration of certain secondary storage devices. Discussion on the characteristics of secondary memory devices.	Explains the characteristics of different secondary storage devices.
Hard Disk and optical disks. Comparing Communicating	Demonstration of Hard Disk and optical Disk storage devices. Discussion on Hard Disk and optical disks.	Explains the characteristics of different secondary storage devices.
Classification of computers	• Preparation of a comparison chart of different types of	Classifies computers on the basis of speed and computing

- Comparing - Analysing	computers. Discussion on the characteristics of different types of computers.	power.
Motherboard of a computer - Communicating - Sketching	Discussion on the functions of computer motherboard.	Explains the functions and structure of motherboard.
Different computer parts - Comparing - Analysing	- Preparation of a comparison chart of different computer parts. - Discussion on the characteristics of computer parts.	Identifies different computer parts.
Different types of computer softwares. - Comparing - Classifying - Analysing	- Discussion on different types of computer softwares. - Preparation of comparison chart of computer softwares.	Classifies computer softwares.
Different system and application softwares. Comparing Communicating	- Discussion on how computer softwares are classified into system and application softwares. - Preparation of a comparison chart based on system and application softwares.	Explains various system and application softwares.
Various computer languages. Illustrating Comparing Communicating	- Discussion on different computer languages. - Preparation of comparison chart showing various computer languages.	Differentiates various computer languages.
	Assessment - Participation in discussion - Involvement in collecting and demonstrating components - Content and quality of chart prepared.	

Functions of the input devices of a computer

Activity 9.1

Demonstration of various input devices. The students are requested to collect as many input devices of computers as they can and demonstrate it before the class. The student who demonstrates one input device may explain the use of that device and different types of such device with which he is familiar with.

Now a general discussion is conducted on the functions of each input device.

Discussion points

- Which device is used to enter text data into a computer?
- What are the special symbol keys included in the keyboard other than alphabets and numerals?
- How a keyboard works?
- Which are the types of mouse we are familiar with?
- What is the difference in functioning of between optical mouse and mechanical mouse?
- What are the uses of joystick, track ball and light pen?
- What is a digitizer?

Thus the functions of input devices of a computer should be transacted to the students using demonstration of various input devices and a general discussion there after as mentioned above.

Now the teacher may consolidate the functions of input devices of a computer.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
General discussion	Activity log book	Unit test
Demonstration of devices	Seminar	
Preparation of charts		

Work Sheets

1. Draw the basic block diagram of a digital computer
2. Complete the following table.

Impact Printer	……………………	Faster
Non-impact printer	Laser Printer	…………………

TE Question

1. (a) I Giga Byte ……………Mega Byte
2. Classify the following into input, output and memory devices (CDROM, RAM, Laser Printer, microphone, floppy disk, ROM, Scanner, flash driver, loud speaker.)
3. (a) A Dot matrix printer is …………………type of printer.
   (b) Distinguish between impact and non impact printers
   (c) Explain the working of a Laser Printer
4. (a) Select secondary memory from the following, (RAM, ROM, Dynamic RAM, Hard disk)
   (c) Distinguish between RAM and ROM
5. (a) The Program used to convert high level language to machine language is called …………..
   (c) Distinguish between compiler and interpreter.
6. (a) What are application software.
   (c) Give examples of application software.

Reference

1. Fundamentals of Computer - V. Rajaraman, PHI
2. Introduction to Computer - Norton Peter, M.Sc Graw Hill

UNIT : 10

INTERNET TECHNOLOGY

Introduction

Internet is the international network of computers. The applications of internet have penetrated in every field of life. In our every day life we use websites for searching information, E-mail for sending & receiving letters, photographs etc. We are familiar with sending online applications and using online shopping sites such as Flip cart, Amazon, Snapdeal etc. In this unit different aspects of networking, different data communication devices and network protocols are discussed in detail.

The contents of this chapter should be transacted to the students through general discussion, preparation of comparison charts, demonstration of devices and data collection and presentation of domain names and IP addresses using ICT. The assessment of students may be done on the basis of participation in general discussion, quality of data presented using chart and the ability to communicate during presentation.

Unit Frame

Concepts/Process skills	Process/Activities with Assessments	Learning Outcomes
Computer networking • Imaging • Communicating	• Discussion on the functions of computer networking. • Discussion on the advantages of networking	• Explains the needs and advantages of computer networking.
Network protocols • Imaging • Communicating	• Discussion on various network protocols	• Differentiates different network protocols
Network topologies • Comparing • Analysing	• Discussion on different netwrok topologies. • Preparation of a comparison chart based on various network topologies.	• Explains the needs of advantages of computer networking • Differentiates different network protocols.
Various data communication devices. Comparing Communicating	• Discussion on various data communication devices. • Preparation of chart showing various data communication devices.	• Comparing different data communication devices.
Functions of MODEM Communicating Sketching	• Discussion on the functions of MODEM • Demonstration of MODEM	• Explains the functions of MODEM
	Assessment • Participation in discussion • Quality of the data presented using chart	
Different types of computer networks. • Communicatin g • Analysing	• Discussion on various computer networks. • Preparation of a comparison table showing various networks.	• Differentiates different types of networks.
Domain names and IP address Comparing Analysing	• Discussion on various domain names and IP addresses. • Data collection and presentation of domain names and IP addresses using ICT.	• Identifies various domain names and IP addresses
Concept of client/server computing, Sketching, comparing	• Discussion on client/server computing • Sketching client/server computing architecture.	• Explains the concept of client/server computing
	• Participation in discussion • Ability to collect data • Ability to communicate during presentation	

Function of MODEM

Activity 10.1

- Discussion on the functions of MODEM.
- Sketching a diagram showing the function of MODEM.
- Demonstration of MODEM.

Discussion on the functions of MODEM

A general discussion should be conducted to transact the functions of MODEM based on the following points.

- How can a personal computer be connected to the internet?
- What types of signals are being carried by the telephone cables Analog or digital?
- For sending and receiving signals through telephone cables by a personal computer what type of conversions of signals are to be done?
- Is there a device with which it is possible to convert digital signals to analog and vice versa ?
- Sketching a diagram showing the functions of MODEM.

After general discussion students are requested to draw a diagram to represent the signal conversions done by MODEM. The teacher should demonstrate an expected. diagram to help the students.

Demonstration of MODEM

With the help of your school laboratory students are advised to demonstrate MODEM and thus explain its ports and demonstrate how to connect a personal computer with MODEM and how to connect MODEM with a telephone cable. Now the teacher may consolidate the functions of MODEM.

Repository of C.E Items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
• Preparation of charts	Activity logbook	Seminar
• Data collection and presentation	Worksheet	

Worksheet

1. Match the following

LAN	Country or Entire word
MAN	Single Site
WAN	Entire city

2. Tell which top level domains are indicated by the following suffixes.
   - Gov ……………
   - Edu ……………
   - Org ……………
   - Mil ……………
   - Com……………
   - Net ……………
   - In ……………
   - Ca ……………
   - Th

Repository of C.E Items

Process Assessment	Portfolio Assessment	Unit based Assessment
• Preparation of charts	• Activity logbook	Seminar.
• Data collection and presentation	• Worksheet	

TE Questions

1. (a) The world wide network of computers is called…………….(Internet)
   (b) What are the advantages of computer networking?
2. (a) The language used for web designing is ……………………(HTML)
   (i) FORTRAN (ii) COBOL (iii) PASCAL (iv) HTML
   (b) An HTML page is transmitted over the web page using …………protocol

   (c) Describe the features of FTP .

3. (a) All the devices share a single communication line or cable in ……….(Bus Topology)
   (i) Bus Topology (ii) Ring Topology
   (ii) Star Topology (iv) Tree Topology

(b) Discuss the features of bus topology with necessary diagram.

4. (a) A computer hardware that allows a computer to connect to a network is generally called…………..(Net work Interface card)

   (b)What are the advantages of a switch over a hub?

5. (a) Name two types of MODEM's used to provide broadband internet

   (b) Describe the functions of a MODEM.

6. (a) Write a URL and identity the domain name.

   (b) Give examples of different Top level domain (TLD's) with their suffixes.

Reference

1. The Internet Complete reference - Hahn, Mc Graw Hill
2. Computer Networking with Internet Protocols and Technology - William stalling

UNIT : 11

BASICS OF TELEPHONE COMMUNICATION

Introduction

Telecommunication is the method of transmission of information between people who are separated by a distance. The basic elements of telecommunication involve a transmitter, a medium for transmitting information and a receiver at the destination. The telephone technology represents duplex telecommunication. So people can transmit and receive information through the same medium. The signals used for transmission may be either analog or digital. World's circuit – switched telephone networks that are operated by national, regional or local telephone operators providing infrastructure and services for public telecommunications is known as public switched Telephone networks (PSTN). In this unit PSTN, electronic exchange, cellular communication, multiple access schemes for cellular systems, GSM, GPS, and GPRS are discussed in detail.

The contents of this unit have to be transacted to the students through general discussion, preparation of charts and sketching diagrams. The classroom assessment of the students may be done on the basis of participation in general discussion, efficiency in data collection and the ability is sketching diagrams.

Unit Frame

Concepts/Process skills	Process/Activities with Assessments	Learning Outcomes
Concept of PSTN • Sketching • Communicating	• Discussion on PSTN • Sketching a diagram of the structure of PSTN	Explains the need of PSTN Sketches the structure of PSTN.
Different switching offices • Comparing • Analysing	• Discussion on various switching offices. • Preparation of chart showing different switching offices	Identifies different switching offices.
Electronics exchange Communicating Comparing	• Discussion on stored program control systems	Differentiates centralized SPC and distributed SPC
Cellular communication Imaging Analysing	• Discussion on cellular communication system.	Describes how cell system is a spectrum efficient system.
Cell system for frequency reuse Imaging analyzing	• Discussion on frequency revise • Sketching diagram showing cell clusters.	Explains the concept of frequency reuse
Requirements for a multiple access scheme. Communicating Imaging	• Discussion on the requirements for a multiple access scheme.	Points out the requirements for a multiple.
Concepts of FDMA, TDMA and CDMA • Comparing • Analysing	• Discussion on various multiple access schemes • Preparation of a comparison chart showing various multiple access schemes.	Differentiates FDMA, TDMA and CDMA.
Concept of GSM Communicating Imaging	• Discussion on GSM	Explains GSM
Concept of GPS and GPRS Communicating Imaging	• Discussion on GPS	Explains GPS Explains GPRS technology.
	Assessment Participation in discussion Efficiency in data collection Ability in sketching diagrams.	

Different switching offices

Activity 11.1

- Discussion on various switching offices
- Preparation of chart showing different switching offices.

Discussion on various switching offices

The teacher demonstrates a diagram showing the structure of a Public switching Telephone network (PSTN). Now a general discussion on various switching offices is conducted on the basis of the following discussion points.

- What is the need for a local telephone exchange?
- What is the need for a larger switching office which connects many local exchanges?
- Through what kind of cable, data from different telephone subscribers are transmitted?
- What is the need for optical fibre cable?
- Why should we use cables of more bandwidth between higher order exchanges?

After general discussions the students are requested to prepare a diagram showing different switching offices.

Now teacher may consolidate the need for different switching offices and different aspects of these exchanges.

Repository of C. items

Process Assessment	**Portfolio Assessment**	**Unit based Assessment**
General discussion	Activity logbook	Framing multiple choice questions
Sketching diagrams	Seminar	Unit test

Worksheet

Match the following

GSM	Provides packet data
GPS	Set of protocols for cell networks
GPRS	Space based satellite navigation

Repository of C.E Items

Process	Portfolio	Unit
General discussion Making charts	Activity logbook	Unit test

T.E. Questions

1. (a) A Subscriber in a telephone network is connected to the end office using…………

   (b) Diagrammatically represent the basic switching method in telephone communication.

2. (a) What do you mean by a stored program control system?

   (b) Distinguish between centralized SPC and distributed SPC.

3. (a) The geographical area of service of the telecom system is split into several smaller regions known as………..(cell)

   (b) Describe the concept of frequency re-use of a cellular system.

   (c) Classify cells according to their physical size.

1. (a) What are the requirements of a multiple access scheme.

   (b) What are the advantages of CDMA technology over TDMA and FDMA technologies?

5. (a) GSM for cell networks uses……………………………(TDMA)

   (i) TDMA (ii) FDMA (iii) CDMA (iv) None of these.

   (b) Describe how GSM works using the above multiple access scheme.

Reference

1. Telecommunication Switching Systems and networks - Thyagarajam Viswanathan
2. Basics of Telecommunications – Stephan .S. Johns.