# CURRICULUM REVISION PROJECT

# 2013

## TEACHER GUIDE FOR DIGITAL TECHNIQUES

## THIRD SEMESTER

**JUNE 2012**

**MAHARASHTRA STATE**
**BOARD OF TECHNICAL EDUCATION, Mumbai**

# CURRICULUM DEVELOPMENT CELL, MSBTE, MUMBAI.

## TEACHER'S GUIDE AND SAMPLE QUESTION PAPER

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# 1. APPROACH TO CURRICULUM DESIGN

## 1.1 INTRODUCTION

Maharashtra State Board of Technical Education is an autonomous organization since April 1999. The main activities of the board are to design the curricula of Diploma and post diploma courses and conduct examinations. Further the Board develops appropriate learning resources – print and non-print – to be used by the students. In order to ensure the quality of education, monitoring of institutions is carried out normally two times in a year. Teachers are the backbone of technical education system and hence efforts are made by the board to provide training opportunities to the teachers. Presently industrial training is arranged for the teachers through Maharashtra Economic Development Council (MEDC). Teachers and supporting staff are also deputed for training organized by National Institute of Technical Teachers Training and Research, Bhopal.

During last five years there has been remarkable change in the industrial scenario. The expectations of present and future industries indicate the changed role of a diploma engineer. It is therefore necessary to redefine the job profile of diploma engineer. This revised job profile will be useful in revising the curriculum.

The basic principle while designing or revising any curriculum is to identify needs of user industries. This data and its analysis help in deciding curriculum objectives and further enable to select appropriate subjects.

Therefore Industry Survey to identify the present and future needs of industry was conducted in July 2011 by the committee appointed for curriculum revision.

For the purpose of revising the curriculum Project Institutes were identified. A team of Coordinators, Core group members and Subject Experts was formed to execute the revision. The team members were identified from various Government, Government Aided and Private Polytechnics.

Training in Curriculum Development of faculty members involved at various levels was conducted. The core group members visited a number of industries to have first hand knowledge about the expectations of industries from diploma passouts. Industry experts were involved at all the stages of curriculum revision and validation.

The details related to curriculum philosophy, curriculum model, curriculum objectives, desired skills, link diagram, salient features and implementation strategy are given below

## 1.2 CURRICULUM PHILOSOPHY

MSBTE has adopted systems approach while designing the scientific based curriculum since 1995. The same approach has been adopted while revising the curriculum in semester pattern.

Fig. No. 1 shows the systems diagram. This diagram provides the holistic view for curriculum designing, development, implementation and evaluation

The input to polytechnic education system is the students having 10+ qualifications. The teaching learning process occurs in the institution for six/eight semesters. The output of the system i. e. Diploma pass out is normally the input to industries. (Some students do go for higher education). While designing the curriculum the expectations of the industries play a major role. Due to globalization and competition the industries expect that pass outs have generic and technological skills along with right attitude.

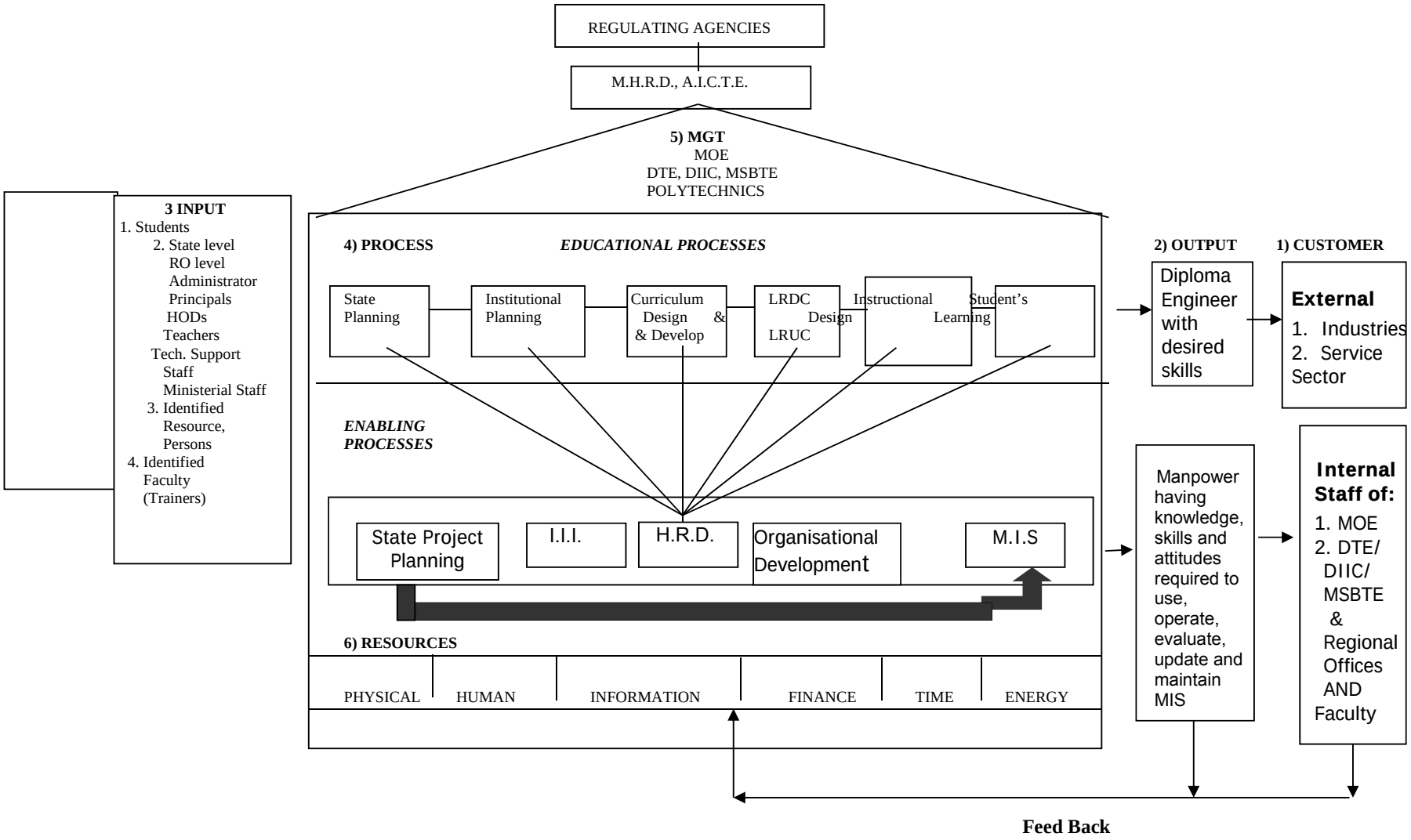



**Fig 1 Systems Approach**

To fulfill the needs derived from systems approach following conceptual framework is considered:

**"Curriculum is an educational program designed and implemented to achieve specified educational objectives"**

This definition takes into account the fact that

- Education is purposeful
- There is an organized plan of action contemplated
- Such a plan is translated into action through appropriate strategies of implementation.

**Following are the key points in the philosophy:**

- Job profile of middle scale industries is considered to design the curriculum including service industries
- Dimensions of curriculum revision are:
  - Individual development
  - Social development
  - Technology development
  - Continued learning
- Subjects for the course are classified as follows
  - Basic sciences
  - Engineering sciences
  - Human sciences
  - Core technology
  - Technology
- Link diagram shows the relationship of various subjects at different categories which helps in deciding the appropriate contents of the subjects
- Practical focuses on development of cognitive skills and psychomotor skills

## 1.3 Curriculum Development Model:

Following are the major steps used for designing the content and subsequent approval:

- Entry Behavior
- User need assessment
- Teacher Training for Curriculum Development
- Industry Involvement
- Validation

## 1.4 Curriculum goals

1. To develop confidence in students by providing more exposure to industry experience and world of work at global level.
2. To provide conceptual knowledge and develop analytical ability
3. To develop communication skill with good English by providing sufficient practice
4. To enhance latest technical knowledge industry interaction and media
5. To develop learning to learn skills and life skills to cope up with industrial culture
6. To impart managerial skills by providing appropriate theoretical inputs
7. To develop problem solving ability through technical projects.

**DESIRED SKILLS**

Industries expect from the diploma engineer the abilities and skills of general nature and specific to the job performance. The curriculum aims at developing life skills and technological skills so that the diploma pass outs would be suitable for industry. The skills are listed below:

**Life Skills:**

- Communication skill
- Team work
- Problem solving
- Leadership
- Decision Making
- Presentation skills
- Report writing skills
- Interpersonal skills
- Information search

**Technological Skills:**

Diploma engineers should possess following intellectual and motor skills in order to satisfactorily perform duties assigned to them:

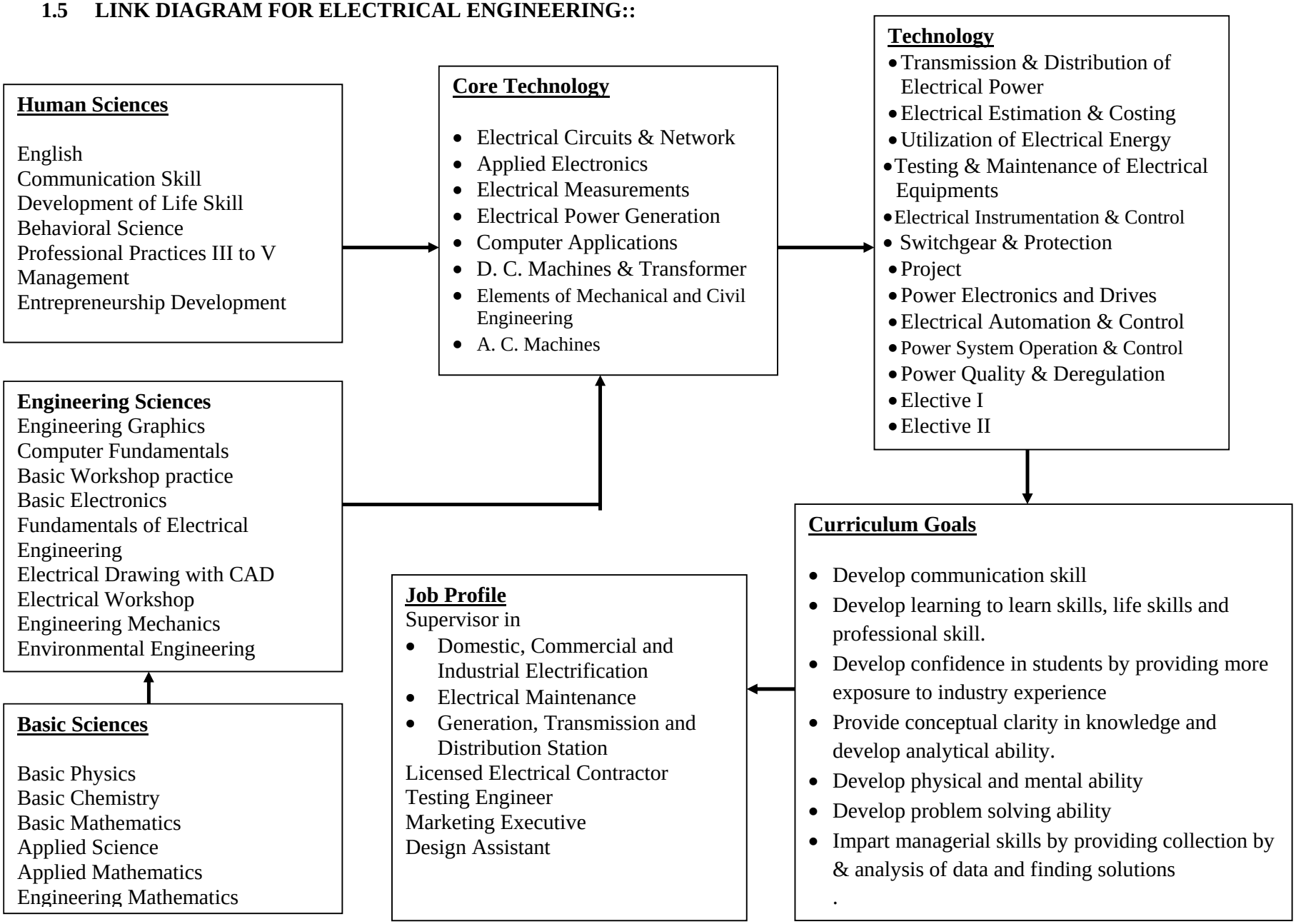
**Intellectual Skills:**

- Use of data sheets, charts, handbooks, standards
- Interpret drawing, circuit diagrams, plant layouts, charts, performance analysis
- Select materials and components
- Locate faults and repairs of faults
- Analyse the data
- Prepare Estimate
- Design of simple components
- Use of computer software

**Motor Skills:**

- Measure accurately different parameters
- Operate machines
- Calibrate instruments
- Repair Faults
- Install machines
- Draw plant layout and Prepare detailed drawing
- Conduct various tests and Draw charactoristics

## 1.5 LINK DIAGRAM FOR ELECTRICAL ENGINEERING::



## 1.6 Silent changes in the Curriculum

In computer Engineering group new subjects line advanced Linux Programming, Scripting Tech., Network Programming and Fiber optic Communication have been added.

# 2. OBJECTIVES

## 2.1 Introduction

Objectives are the statements which describe the expected learning outcome. Such statements enable teachers to plan instructional process with appropriate resources. These objectives also provide a direction to frame proper questions to assess the learning outcome.

During last decade there has been research on cognitive approach in psychology. This approach is based on biological structure of brain and meta-cognitive knowledge dimension. Important elements of this approach which form basics of learning are explained below.

## 2.2 Basic Model of Learning

The basic model of learning is as shown below:

**GENERIC DIAG. – Stimulus and Response**

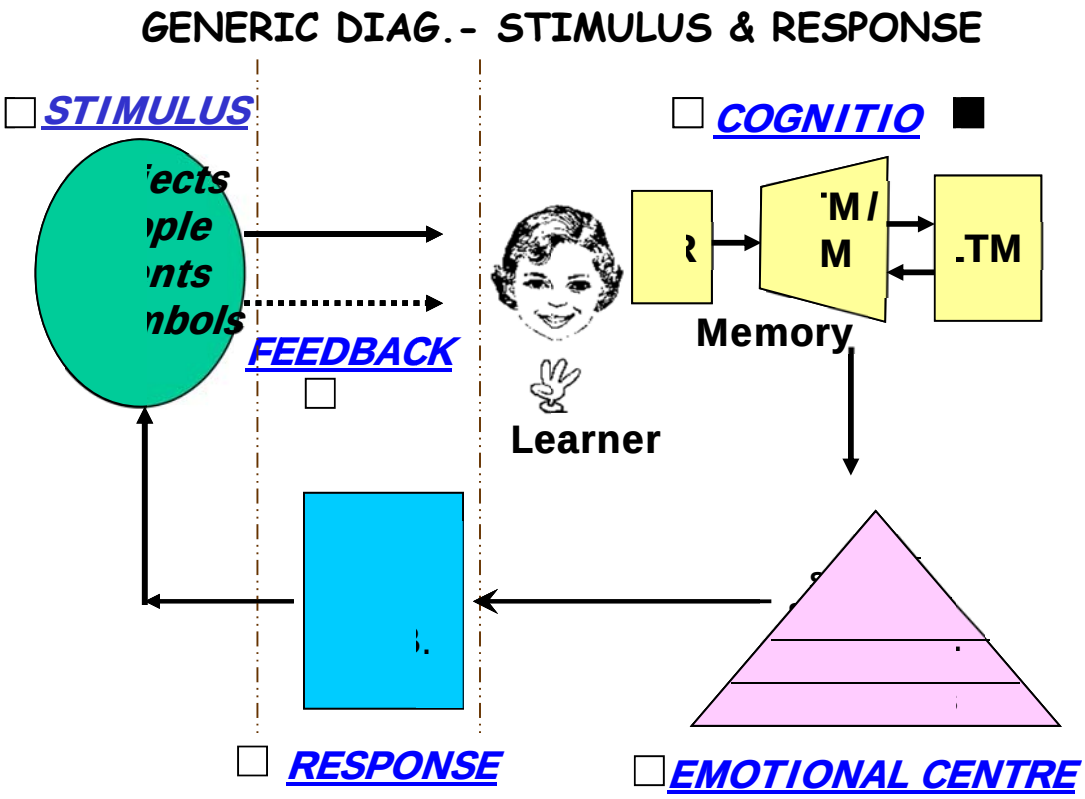



Fig. 2: Generic Diagram of Learners.

**Stimulus:** The information is received by senses from many things in surroundings. It activates senses for experience. It is called as stimulus. It. includes people, objects, events, symbols etc. For example: teachers, friends, instruments, drawings, text etc are stimulus for students.

**Cognition:** Cognition is the act of knowing. It deals with mental activities of the learner. It is triggered due to stimulus. It involves memory, its components structure of knowledge in memory and various processes in memory. The study of the same is done to know how learning takes place.

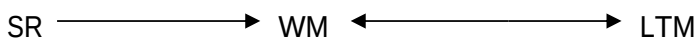
**Emotional Centre:** Stimulus may be pleasant or unpleasant feelings. It decides whether learner will approach to stimulus situation or avoid it. This is the effect of emotions of learners in emotion centre.

**Response:** When stimulus stimulate the learner reacts. This response may be mental response like reflection of face (cognition), physical movement (motor skills) or verbal response like communication. The response always aims at changing the stimulus situation.

**Feedback:** When teacher asks the question, you answer it. Then based on the content of the answer, teacher says whether it is 'correct' or 'wrong'. This is feedback. Thus it may be the information about the changed stimulus situation provided after response by the learner. Feedback helps learner to compare changed stimulus to expected change in stimulus.

**Basic Concepts:** Different forms used in the study of memory and its working are as below:

- **Memory:** It is the ability to recall the information, which has been previously learnt through experience. In context of memory structure, it is the location learned information is stored.
- **Storage:** It is process of putting information in the memory.
- **Encoding:** In memory, the information is not stored in original form but in numerical form, verbal form, visual images etc. Encoding is the process of modifying information from one form to another form. It helps to store information easily. It also stores new information to existing knowledge.
- **Retrieval:** It is the process to find the information that is previously stored in the memory so that it can be put to use.
- **Components of Memory:** The most prevalent view of human memory states that memory has three distinct components viz.
  - **Sensory Register (SR)**
  - **Working Memory (WM) or Short Term Memory (STM)**
  - **Long Term Memory (LTM)**
- **Control Process:** This is the process of movement of information from one memory component to another memory component.




- **Perception:** It is the final image formed in WM after processing the information from SR and LTM. The final image consists of visual image supported by elaboration and emotional content.

### 2.3 Domains of Learning:

Learning is a process by which students develop relatively permanent change in mental associations through experience. This is how learning is defined by cognitive psychologists. Behavioral; psychologists define learning as a relatively permanent change in behavior.

There are following domains of learning:

A: Cognitive Domain relates to intellectual skills or abilities

B: Affective Domain relates to emotions, feelings, likes, dislikes etc.

C: Psychomotor Domain relates to manipulative skills of hands, legs. Eye-hand coordination in Engineering & Technology courses, endeavor is made to design curriculum with a focus on development of cognitive skills through classroom teaching. Where as manipulative (psychomotor) skills are developed in workshops, laboratories & seminars where students work individually or in a group. Development of affective skills attitudes and value is supposed to be acquired through projects and co curricular activities. These are also developed from the work culture or institutions.

How far a student has developed these abilities/skills especially from cognitive and psychomotor domains is assessed on the basis of suitable examinations. When classroom and laboratory teaching is viewed in this light, evaluation becomes an integral part of teaching – learning process.

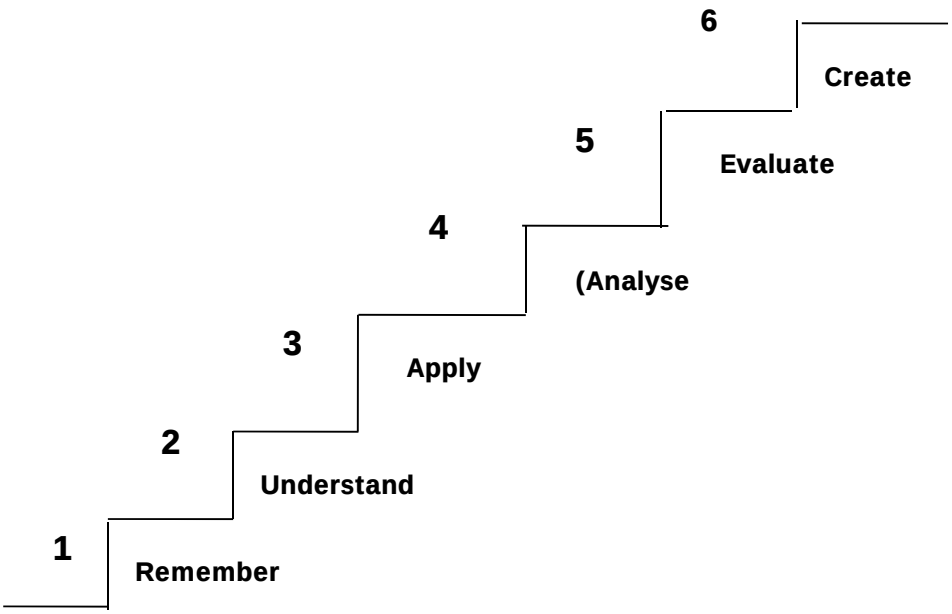
## 2.4 LEVELS OF LEARNING:

Question paper is a tool/ instrument designed to test the extent of learning of the student. Various questions set in a question paper should assess the abilities of students to respond to level of learning. Dr. Bloom a German educationist classified levels of learning in cognitive domain for the purpose of writing objectives and assessment. Dr. Bloom's revised taxonomy is based on cognitive psychology and is two dimensional. First dimension is cognitive process dimension ad other is knowledge dimension. Details of these two dimensions are given below.

### 2.4.1 Cognitive Domain:

Dr. Benjamin Bloom (1956) analysed questions asked in various examinations in American situation and proposed a hierarchical arrangement of instructional objectives (Intellectual abilities) tested by these questions.

The lowest level of cognitive learning achieved by a student is demonstrated by the recall of information that the student retrieves from his long term memory. So, the storage and retrieval of specific facts, concepts, principles, laws, definitions, properties, procedures etc. directly from memory was classified as a knowledge level objective. Thus questions testing memory of students were treated as at the lowest level of the hierarchy of intellectual abilities. The other levels of hierarchy proposed by Dr. Bloom in 1956 relate to the degree of information processing required in the brain needed to provide answer to a question. The various levels in the cognitive hierarchy proposed by Dr. Bloom in 1956 and further revised in 2001 are given below in the diagrammatic form.




Following are the details of each level which indicate the general and specific objectives. Further appropriate verbs are given which are useful in setting good questions. In this table only four levels are considered for diploma students.

| Description of the Major Levels in the cognitive Domain (Bloom's Taxonomy) | Illustrative General Instructional Objectives | Illustrative verbs for stating specific learning outcomes |
|---|---|---|
| **Remember –** Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required to mind of the appropriate information. This represents the lowest level of learning outcomes in the cognitive domain | Knows common terms, specific facts, basic concepts, principles, methods & procedures | Define, describe, identify label, list, match, name, outline, reproduce, select, state |
| **Understand –** This is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words or numbers) by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). Draw sketches these learning outcomes go one step beyond the simple remembering of material and represent the lowest level of understanding. | Understands fact, principles Interprets verbal material, Interprets charts, tables, graphs. Translates verbal material to mathematical formula. Estimates consequences implied in data. Justifies methods & procedures. | Convert, distinguish estimate, explain, extend, generalize, give examples; infer, paraphrase, predict, rewrite, summarize, draw labeled sketches. |
| **Apply –** Application refers to the ability to use learned material in new and concrete situations. This may include the application of | Applies principles to new situations. Applies theories to practical | Change, compile, demonstrate, discover manipulate, modify |

| | | |
|---|---|---|
| such things as concepts, principles, rules, methods, laws and theories. Learning outcomes in this area require a higher level of understanding than those under the level described earlier. | situations. Solves mathematical problem. Construct charts, graphs Demonstrates correct usage of a procedure | operate, predict, prepare, produce, show, solve, use. |
| **Analyze –** Analysis refers to the ability to break down material into its component parts so that its organizational structure may be understood. This may include the identification of the parts, analysis of the relationship between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than "understand" and apply because they require an understanding of both the content and the structural form of the material. | Recognizes unstated assumptions and logical fallacies in reasoning. Distinguishes between facts and inferences. Evaluates relevance/ adequacy of data. | Breakdown, diagram, differentiate, discriminate, distinguish, identify illustrate, infer, outline, point out, relate, select, separate, subdivide. |

### 2.4.2 Categories of Knowledge Dimension

After considering the various designations of knowledge types, especially developments in cognitive psychology that have taken place since the original framework of Bloom's taxonomy, knowledge is categorised in 4 types – Factual , Conceptual, Procedural and Meta-cognitive.

*Factual Knowledge (A)* is knowledge of discrete, isolated content elements. It includes knowledge of terminology and knowledge of specific details and elements. In contrast,

*Conceptual Knowledge (B)* is knowledge of "more complex, organised knowledge form". It includes knowledge of classifications and categories, principles and generalizations and theories, models and structures.

*Procedural Knowledge* (C) is "knowledge of how to do something". It includes knowledge of skills and algorithms, techniques and methods, as well as knowledge of criteria used to determine and/or justify "when to do what" within specific fields and disciplines.

*Meta-cognitive knowledge* (D) is "knowledge about cognition in general as well as awareness of and knowledge about one's own cognition. It encompasses strategic knowledge, knowledge about cognitive tasks, including contextual and conditional knowledge; and self-knowledge".

Assessment is required to be done on the basis of categories of knowledge and levels of learning.

Table below indicates the two dimensional grid based on Blooms Taxonomy for setting questions.

| Knowledge | COGNITIVE PROCESS DIMENSION |
|---|---|

| Dimension | 1 Remember | 2 Understand | 3 Apply | 4 Analyze |
|---|---|---|---|---|
| A. Factual Knowledge | | | | |
| B. Conceptual Knowledge | | | | |
| C. Procedural Knowledge | | | | |
| D. Meta-cognitive Knowledge | | | | |

## 2.5 Components of Curriculum:

**2.5.1 Rationale:** It indicates the logical basis for the inclusion of the subject in the curriculum It also indicates the importance of the subject related to entire curriculum.

Importance of the subject is on two counts:

One the knowledge gained while studying the subject helps understand and develop further knowledge of the subject or understand and effectively learn the higher level subjects.

The other indicates how the knowledge gained can be used in the world of work to perform given tasks.

Rationale tells the students the connection of subjects related to study of higher level subjects and also the us in their job/profession.

**2.5.2 Objectives:** Objectives indicate what the student will be to do/perform after he completes the study of the subject. It also in other words indicate the scope of the subject.

Objectives indicate what is achievable and hence gives direction ot the student about how to study the subject, what important things are to be observed and performed during practicals.

Just as rationale indicates the use of the knowledge gained while studing the subject, objectives indicate how efficiently and effectively one can work if the objectives are fulfilled while studying the subject.

**2.5.3 Learning Structure:** It graphically/pictorially indicates the content of the curriculum of the subject and what is to be learnt in the subject. As you know that in Cognitive Domain knowledge is divided in four components Factual, Conceptual, Procedural and Metacognitive. Of this Factual, Conceptual and Procedural knowledge components are identified in the curriculum of the subject along with the applications. Learning structure gives broad idea of these components for a subject. It indicates the scope of the subject. Normally we first decide what we want to achieve by studying the subject, which forms the application component. Based on this we decide what procedures are required for these applications.

Facts, Concepts, Principles are used in developing procedures and applications. So these are given sequentially below procedure as Principles, Concepts and Facts in their order. Learning structure also provide an idea about how to develop the subject logically to achieve the objectives.

**2.5.4 Contents:** List of topics and subtopics to be included in the curriculum of the subject is given in the contents. This helps in achieving the rationale and objectives identified. Contents indicate the importance of the topics, sub topics in development of the subject and accordingly weightages in

terms of Hours required to teach the subject components, so that the desired learning takes place. Marks to be allotted while testing the knowledge gained by the student are also indicated.

One has to be careful in allotting the hours required to teach the topics looking at the importance of the topic for development of the subject. There fore it is necessary to provide sufficient time to teach concepts and principles so that they are well understood by the students as they form the basis for development of the subject.

**2.5.5 Practicals:** While designing the curriculum the objectives are identified. To achieve these objectives students have to develop certain intellectual and motor skills. These skills are developed through well designed Practicals. So in the curriculum the list of the skills to be developed through Practicals is given. The list of Practicals is so developed that after performing the Practicals identified skills will be developed. Here it is necessary that the teacher gives enough opportunity to all the students to perform the practical properly to develop the skills in each one of them.

The skills will be developed if the students actually perform certain activities or tasks. Therefore it is necessary that any practical included in the curriculum necessarily involve some activities to be done by the students. So there should not be any study type experiment as it is nothing but repetition of what is taught in the theory class. So one has to think and innovate to modify the study experiments so that students will be asked to perform some activity. It could be in terms of identifying components, listing of materials used for manufacturing the components, stating importance of use of certain materials etc.

So any curriculum of a subject is so designed that it achieves the objectives of that subject as well fulfill the objectives of the entire curriculum

# CONTENT ANALYSIS

## 3.1 Components of Content Analysis:

As we have discussed earlier, any curriculum or syllabus of a SUBJECT given to the teacher is organised in terms of UNITS which include TOPICS or SUB-TOPICS as the case may be indicating the TIME in which it is expected to be taught to the students. Components of a topic or part thereof are analysed here at a micro level.

Before we begin actual leaching of any topic (lesson), we must carefully and critically analyse it so that we can plan for teaching - select appropriate media, methods and techniques of teaching and arrange the suitable resources to be required. This analysis of the content of a Topic results in identification of the following components of the content:

1. Facts
2. Concepts
3. Principles (rules, laws, theories)
4. Applications
5. Procedures
6. Skills (Psychomotor Skills), and
7. Attitudes (underlying affective behaviors as quite often these are not specifically mentioned in the syllabus, still they are to be developed lesson after lesson gradually).

When we undertake the exercise of content analysis, we ourselves understand the subject fully well and at the same time we become clear as to what we are going to teach It also gives us an idea as to which methods of teaching and media of instruction we It also gives us an idea as to which methods of teaching and media of instruction we should prepare and use and also what resources including time we will require. This analysis will also enable us to design assignments as well as how we are going to assess students learning.

Since the nature of the components of content (I to 7) differs from one another. These are learned by the students differently as different mental processes are involved in learning these components. The immediate implication of this varying nature of components is that these need to be taught differently and assessed differently. For example, if you look at components I to 5 all of which belong to Cognitive Domain of Learning; Component 6 belongs to Psychomotor Domain and Component 7 belongs to Affective Domain (cannot be taught as these attitudes are caught), you will find that these differ from one another. The classification of human behaviors (activities) into the above three domains of learning entails the use of entirely different methods and media of instruction. Different locations of learning (classroom, laboratories, workshops, field visits) need to be selected.

Now we will discuss these components in some detail and see how each one of these should be taught and assessed differently.

### 3.1.1 FACTS:

These are universally accepted and commonly understood items about which there cannot be much argument and discussion. These are required only to be informed. For example: The sun rises in east and sets in the west; names of scientists and the year in which their theories were propounded; the rules and regulations of admission and examination prescribed by the University are some of the examples of facts. Sometimes, they need not be emphasised in the class as the students already know them. But information can be passed on by word of mouth, if deemed necessary.

### 3.1.2 CONCEPTS:

A concept is an abstraction or an idea that permits the learner to classify a variety of related phenomena into a convenient and meaningful category. Concept of something is like a picture formation of that thing which helps in conceptualizing it. Gagne says that concept learning produces a certain fundamental change in human performance that is independent of subject or content. Concepts can be divided into the following two categories:

1. **Concrete Concepts:** those which can be seen, touched and manipulated e.g. house, book, table, chair, cat, dog, any machine or apparatus, overhead projector, chalkboard and duster.
2. **Abstract Concepts:** those which cannot be seen and touched and handled but can only be imagined e.g. force, work, fractions, decimal, bending moment, moment of inertia, friction, heat, and induction. Teaching of concrete concepts is not that difficult because the teacher can show the object physically or its picture. On the contrary, teaching of an abstract concept offers difficulty to the teacher as well as for students to understand. These concepts can be learned by heart without understanding as children mug up Nursery Rhymes without understanding even a single word. But at the stage of higher tearing, this type of rote learning is not desirable. Adolescents (teenagers) and adults do not accept things without understanding.

### 3.1.3 Concept Attributes:

We identify a concept and understand it, once we are told about its qualities characteristics, and features. They are technically called concept attributes. While teaching a concept to our students we must spell out as many attributes as possible for better understanding of the concept.

***Example:*** The Concept **of Friction**

**Attributes:**

1. Friction is a resistive force.
2. Frictional force acts in the direction opposite to the direction of the applied force.
3. Frictional force is more when the surfaces in contact are rough.
4. Smooth surfaces (perfect) have zero friction.
5. Frictional force is self-adjusting to a limit.

Towards the end of this Theme Paper a number of examples of concept attributes are given for your guidance.

The following questions pertaining to a concept (object or process) will be helpful in writing concept attributes:

1. What it is.
2. What are its constituent parts.
3. How it works.
4. How it is similar to and different from other known concepts.
5. What are its uses?

### 3.1.4 PRINCIPLES:

A principle is a statement of relationship between two or more concepts. Principles are sometimes called rules, laws or generalizations. In others words, relationship between two or more concepts which is scientific and universally true is called a Principle.

*For Example:* (related concepts are underlined)

1. Actions and reactions are equal and opposite.
2. Ohm's law I = V/R is a principle, where I (Current), V (Voltage), and R (Resistance) are the concepts. While teaching a principle we must recall the concepts which it involves. These concepts might have been taught in the previous lesson. As you already know, concept learning is a prerequisite to Principle learning. Thus we recall the concepts of current, voltage and resistance by asking questions to the students. Only after that we must tell the relationship among these i.e. Ohm's Law.

### 3.1.5 APPLICATIONS:

Whatever principles, laws and theories have been learned are only academic exercises unless these are applied to solve a practical problem. In other words, we call this application transfer of learning to a new situation. If you recall, the process of learning dealt with in Theme Paper 2, you will appreciate that the litmus test of learning having occurred is its application in a new situation or solving a new problem.

***For example:***

1. Ohm's law can be applied to find out the unknown quantity (voltage, current, and resistance).
2. Design of a structure can be made based on related principles and theories.
3. Principles of learning and events of instruction can be applied in ‘Designing a lesson Plan' and 'Presenting the lesson in the classroom".
4. The above principles can also be applied while preparing textbooks, workbooks, learning packages and laboratory manuals to be used by the students.

### 3.1.6 PROCEDURES:

While analysing the content of a topic you might come across certain standard procedures which are prescribed to perform an operation or a given task. These procedures should be clearly identified and taught accordingly not to be left to chance. We should not pre-suppose that the students understand them. We cannot afford to take these things for granted.

***For Example:***

1. Procedure of setting up of an apparatus.
2. Procedure to start an engine.
3. Procedure to operate a machine (a lathe).

### 3.1.7 SKILLS (PSYCHOMOTOR):

A skill is an ability to perform a task expertly and well. The skilled performance; must meet a pre-specified standard of acceptable performance. A skill has the following three characteristics:

1. It represents a chain of motor responses;
2. It involves the co-ordination of hand and eye movements, and
3. It requires the organization of chains into complex response patterns.

Skills could be intellectual (thinking, understanding); interactive (communication skills) and social (socialising, mixing up with others) also. But normally when we use the word skills, it refers to psychomotor skills.

***For Example:***

1. Welding a butt joint,
2. Setting a theodolite at a station,
3. Making proper circuit connections, and
4. Turning a job on a lathe machine.

Laboratories and workshops of Polytechnics are the locations where these skills are developed among the students under the guidance of expert instructors *of* operators. Drill and practice are the main methods of teaching and learning these skills through model demonstrations and careful observations thereof. Alongside developing these skills, desirable attitudes like cooperation, team work, leadership, safety, cost consciousness are also developed.

## 3.2 TEACHING OF CONCEPTS;

In order to teach concepts effectively the following steps have been suggested by De Cecco & Crawford (1974).

**Steps Suggested:**

1. Describe the performance expected of the student after he has learned the concept.
2. Reduce the number of attributes to be learned in complex concepts and make important attributes dominant.
3. Provide the student with verbal indicators (explanation).
4. Provide positive and negative examples (non-examples) of the concept.

5. Present the examples in close succession or simultaneously.
6. Provide occasions for student responses and the reinforcement of these responses, and
7. Assess the learning of the concept.

## 3.3 TEACHING OF PRINCIPLES:

De Cecco & Crawford (1974) has suggested the following steps for teaching principles effectively.

**Steps:**

1. Describe the performance expected of the student after he has learned the principle.
2. Decide and indicate which concepts or principles the students must recall in learning the new principle.
3. Assist the student in the recall of component concepts.
4. Help the student in the recall of component concepts.
5. Help the student to combine the concepts and put them in a proper order.
6. Provide for practice of the principle and for reinforcement of student responses.
7. Assess the learning of the principle.

## 3.4 CONCLUSION:

To sum up, it can be said that. it is essential for the teachers to develop the skills of 'Content Analysis' of their subjects. It brings content clarity among teachers themselves. More importantly, Content Analysis will be a pre-requisite for writing Instructional Objectives of the topic to be taught. You will study Instructional Objectives in a separate Theme Paper in detail. Teaching and learning process is bound to be effective once these crucial academic activities are undertaken.

## 4. Curriculum:

**Course Name : Computer Engineering Group**
**Course Code : CO/CM/IF/CD/CW**
**Semester : Third**
**Subject Title : Digital Techniques**
**Subject Code : 17333**
**Teaching and Examination Scheme**:

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | -- | -- | 25@ | 125 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

The application areas of digital electronics have been increasing day by day, resulting in unprecedented interest in the subject. The power of digital techniques and systems can be seen from wide variety of industrial machinery, computers, microprocessors, house hold appliances, medical equipment, internet, e-banking etc. which are based on principles of digital electronics. So the subject Digital Techniques has been introduced as a core technology subject, in Computer Engineering Curriculum.

It will enable the students to assemble, design, test and troubleshoot logical circuits like:- MUX, DEMUX, COUNTERS, REGISTERS. This subject covers the number systems, basic & logic gates, combinational & sequential logic circuits, memories and ADC / DAC converters which form an important part of digital systems.

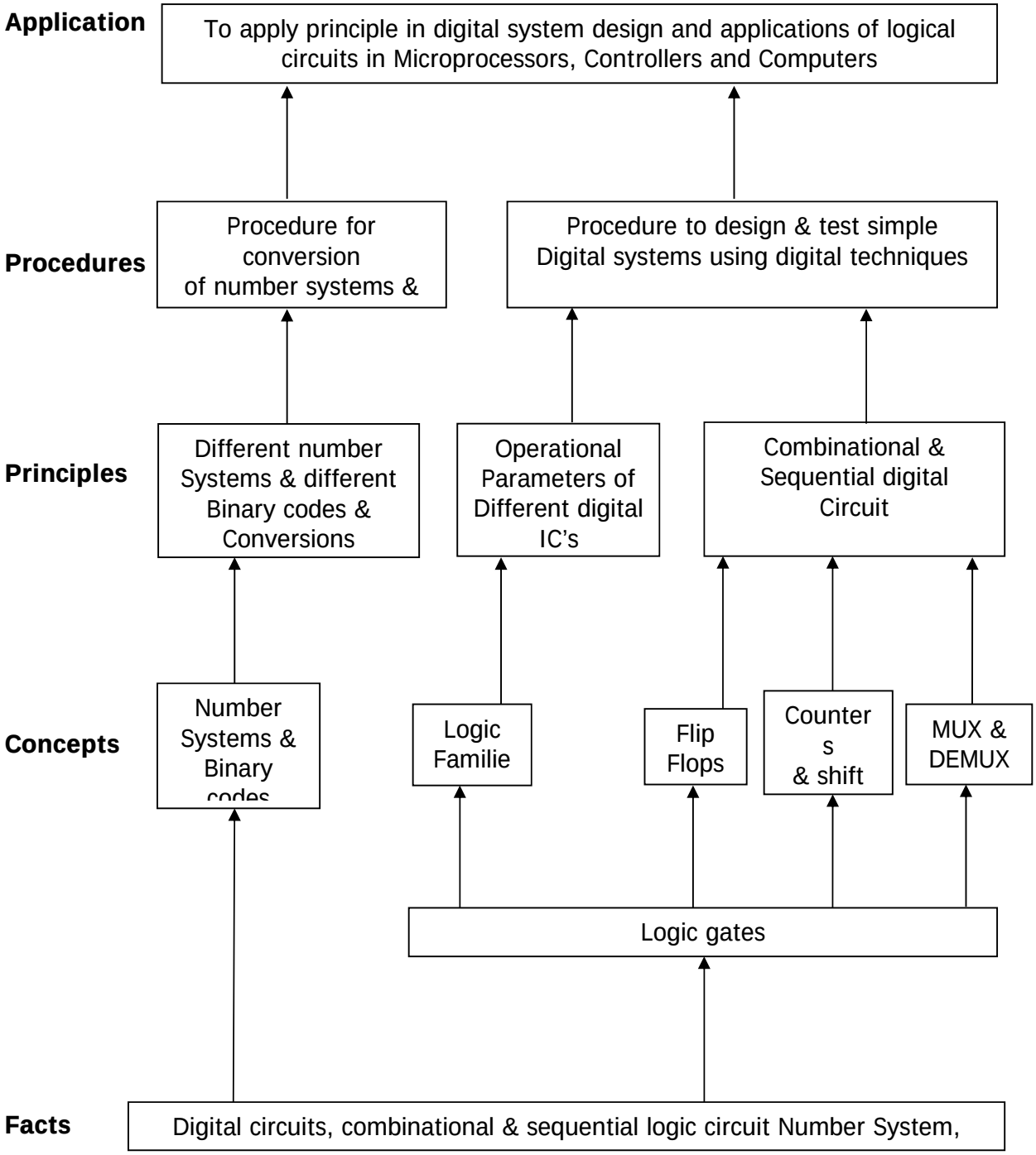
This subject is the foundation for knowledge of computers, Advanced Microprocessor and Embedded Systems.

**Objectives**:

The student will be able to:

1. Understand the Digital Systems and Logic Families
2. Select a logic gate for specific application
3. Draw ladder network diagrams

**Learning Structure:**



**Theory:**

| Topic No. | Name of the Topic | Hours | Marks |
|---|---|---|---|
| 01 | **Introduction to Digital Techniques**<br>**Objectives:-**<br>➢ Understand the Digital Systems and Logic Families.<br>➢ Identification and conversion of different number systems.<br>1.1 Digital signal , Digital systems- Positive and Negative Logic, Advantages , Disadvantages and Applications of Digital Systems<br>1.2 Logic families- Characteristics, Classification - TTL, CMOS, ECL (Comparison only) (No circuits)<br>1.3 Number System- Classification - Binary, Octal, Decimal, Hexadecimal number system, Conversion of number systems, 1's complement and 2's complement, Binary arithmetic, BCD code, BCD arithmetic. | 08 | 16 |
| 02 | **Logic Gates**<br>**Objectives:-**<br>➢ Understand Boolean Laws and concept of Logic Gates.<br>2.1<br>• Basic gates (AND,OR, NOT), Universal gates(NAND, NOR), Derived gates(EX-OR, EX-NOR) - Logical symbol, logical expression and truth table of gates- Deriving all gates using universal gates, Multiple input gates (3 - inputs)<br>• Boolean laws- De Morgan's theorems. **(10 Marks)**<br>2.2<br>• Application of Boolean laws to simplify the Boolean expressions.<br>• Construction of logical circuits by simplifying the Boolean Expression. **(08 Marks)** | 08 | 18 |
| 03 | **Combinational Logic Circuits**<br>**Objectives:-**<br>➢ Reduction of Boolean expression using K-map<br>➢ Understanding and designing of Multiplexer, Demultiplexer, Encoder, and Decoder.<br>3.1 SOP & POS – Concept, Standardization.<br>• K-map representation of logical functions minimization using 2, 3, variables.<br>• Designing of (a) Half adder and Half subtractor (b) Full adder and Full subtractor using K-map, basic gates and universal gates.<br>• Multiplexer – Block diagram, Truth table, Logical expression and logic diagram of Multiplexers (2:1, 4:1, 8:1and 16:1), Multiplexer Tree.<br>• Demultiplexer – Block diagram, Truth table, Logical expression and logic diagram of Demultiplexer (1:2, 1:4, 1:8and 1:16), Demultiplexer Tree. **(16** | 12 | 26 |

| | | | |
|---|---|---|---|
| | **Marks)**<br>3.2<br>• Priority Encoders - Decimal to BCD Encoder (IC 74147) and Octal to Binary (IC 74148) - Block diagram, Truth table.<br>• Decoder - BCD to 7-segment Decoder (IC 7447) - Block diagram, Truth table.<br>• Digital comparator IC (7485) - Block diagram, Truth table.<br>• ALU 74181 **(10 Marks)** | | |
| 04 | **Sequential Logic Circuit**<br>**Objectives:-**<br>➢ Understanding the concept one bit memory cell – Flip-flop and their Applications.<br>4.1<br>• Introduction to Sequential Logic Circuit – Difference between combinational and sequential circuit<br>• One-bit memory cell, clock signal – Triggering methods: edge triggering and level triggering (Positive and Negative)<br>• Flip Flops - R S flip-flop, Clocked R S flip flop, J-K flip flop, Master slave J-K flip flop, D- flip flop and T-flip flop - using NAND gates - Symbol , Logic diagram, working, truth table and Timing diagram. **(10 Marks)**<br>4.2<br>• Applications of flip flops –<br>a) Counters – Concept, Modulus:- Types of counters, Comparison Asynchronous counter (3 bit, 4 bit), mod N-counter, Synchronous counter (3-bit) – Designing, Working, Truth Table, Timing diagram and Applications.<br>b) Shift register - SISO, SIPO, PISO, PIPO (4-bit) – Block diagram, Working, Truth Table, Timing diagram and Applications.<br>Universal Shift register (IC 7495) (Only pin diagram) **(14 Marks)**<br>4.3<br>• Memories – Classification – Explanation of RAM, ROM, PROM, EPROM, $E^2$PROM. **(04 Marks)** | 14 | 28 |
| 05 | **A-D And D-A Converters (No Mathematical Derivations)**<br>**Objectives:-**<br>➢ To understand different Analog to Digital and Digital to Analog Conversion Techniques.<br>• DAC - Weighted resistor and R-2R Ladder - Circuit diagram, working, Advantages and Disadvantages- DAC specifications<br>• ADC - Ramp, Dual slope and Successive approximation - Circuit diagram, working, Advantages and Disadvantages- ADC Specifications. | 06 | 12 |
| | **Total** | **48** | **100** |

**Intellectual Skills:**

1) Understand various logic families and number system
2) Understand Boolean Algebra and design the logic circuits
3) Design Combinational and Sequential Logic circuits using logic gates and their applications
4) Know different types of memories in computers
5) Understand the concept of data conversion from Analog to Digital and vice- versa

**Motor Skills:**

1) Ability to build the circuit.
2) To observe the result and handling the equipments.

**List of Practical (Any TEN) including MINI PROJECT:-**

| Sr. No | Title of Experiments | No. of Hours |
|---|---|---|
| 1 | To know your laboratory of Digital Technique and Study of Digital IC datasheets and noting down the characteristics for TTL & CMOS logic families. | 02 |
| 2 | Verification of truth table of logic gates. | 02 |
| 3 | Verification of De Morgan's theorem. | 02 |
| 4 | Construction of Half adder and Full adder. | 02 |
| 5 | Implementation of Combinational Circuit using Multiplexer | 02 |
| 6 | Construction of 7-segment decoder driver. | 02 |
| 7 | Verification of truth table of Flip flops. | 02 |
| 8 | Universal Shift Register. | 02 |
| 9 | Decade counter using IC 7490. | 02 |
| 10 | Design of 3-bit Synchronous counter. | 02 |
| 11 | A MINI PROJECT (Design, Assemble, Test and Troubleshoot) integrating minimum two digital ICs | 04 |

**Learning Resources:**

**Books:**

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 01 | Modern Digital Electronics | R. P. Jain | Tata McGraw Hill |
| 02 | Digital Principles | Malvino Leach | Prentice Hall of India |
| 03 | Digital Fundamentals | Thomas Floyd | Pearson |
| 04 | Digital Electronics | Anil K Maini | Wiley Precise Text Book |

**CDs, PPTs, etc:**

www.vikaspublishing.com/teachermanual.aspx

**Website:**

www.digitalcircuits.com

## 5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

***[The methods used to explain the contents are just guideline. Any relevant methods can be used For better understanding of students and effective teaching learning process]***

| | |
|---|---|
| **Topic 1** | **Name: Introduction to Digital Technique**<br>**Facts:** Digital signal, Positive logic, Negative Logic, Logic families, Number system, BCD code<br>**Concept:** Binary Number System, Octal Number System, Decimal number system & hexadecimal number system<br>**Principles:** Conversion of one number system to another, 1's complement, 2's complement, BCD arithmetic<br>**References material:** R. P. Jain, Malvino Leach<br>**Teaching Aids:** Chalk-Board, PPT on logic families<br>**Websites:** http://uojcourses.awardspace.com, www.ccse.kfupm.edu.sa |
| **Lecturer No.** | **Topic / Subject to be covered** |
| 1 | Digital signal , Digital systems- Positive and Negative Logic, Advantages , Disadvantages and Applications of Digital Systems (give real Time applications) |
| 2 | Characteristics i.e. propagation delay, Speed of operation, Power dissipation, Noise immunity, Fan-in, Fan-out, |
| 3 | Classification of logical families and their comparison (TTL, CMOS, ECL) based on the above characteristics |
| 4 | Introduction to Number System<br>♦Binary system<br>♦Decimal System<br>♦Conversion of Binary to Decimal & Vice versa |
| 5 | Introduction to Octal & hexadecimal<br>♦Octal system<br>♦hexadecimal system<br>♦Conversion of octal to binary, decimal & hexadecimal<br>♦Conversion of binary to octal, decimal to octal, hexadecimal to octal<br>♦(At least 5 examples of each conversion) |
| 6 | ♦Conversion of hexadecimal to binary, decimal, octal<br>♦conversion of binary to hexadecimal<br>♦Conversion of decimal to hexadecimal<br>♦Conversion of octal to hexadecimal<br>(At least 5 examples of each conversion) |
| 7 | 1's Complement, 2's Complement<br>♦Binary Addition, Subtraction, Multiplication, Division |
| 8 | BCD code, BCD Addition, BCD Subtraction<br>(Considering different types take 5 examples.) |

| | |
|---|---|
| Topic 2 | **Name: Logic Gates**<br>**Facts:** Basic Gates → AND, OR, NOT De Morgan's Theorem, Logical symbol of gates, Truth table of Basic Gates, Logical Expressions<br>**Concepts:** Universal gates, Derived gates, Boolean Laws, Multiple Input gates, Truth table of Derived gates<br>**Principles:** Proof of De Morgan's Theorems & AND Laws, OR Laws, Communicative , Associative and Distributive Law, Duality Theorem, Simplification and construction of Logical circuits of Boolean expressions<br>**Reference Material:** R. P. Jain<br>**Teaching Aids:** Chalk-Board<br>**Websites:** www.just.edu.jo |
| **Lecturer No.** | **Topic / Subject to be covered** |
| 1 | ♦Basic gates – Symbol, T.T & Logical Expression<br>♦Derived gates - Symbol, T.T & Logical Expression<br>♦Multiple input gates (May be elaborated in Lab) |
| 2 | De Morgan's Theorem with proof by Perfect Induction Method |
| 3 | Boolean Laws & Duality Theorem |
| 4 | Universal gate: NAND & NOR gates<br>♦ Significance<br>♦Implementation of other gates using NAND gates only |
| 5 | Implementation of other gates using NOR only |
| 6 , 7 | Simplification of Boolean Expressions (Take at least 15 examples) |
| 8 | Logical Circuits<br>Implementation of Boolean Expression using<br>♦Basic gates<br>♦Universal gates |

| | |
|---|---|
| **Topic 3** | **Name: Combinational Logic Circuits** |
| | **Concepts:** → ♦ SOP & POS<br>♦K – map<br>♦Definition of Half- adder(HA), Full- adder(FA), Half Subtractor(HS), Full Subtractor(FS)<br>♦Definition of Mux, Demux, Encoder, Decoder |
| | **Principles:** ♦Minimizing using K – maps<br>♦Standardization of Logical Expression<br>♦Design of HA, HS, FA, FS<br>♦Design of Mux & Demux using gates<br>♦Mux tree ; Demux tree<br><br>**Reference Material:** R. P. Jain<br>**Teaching Aids:** Chalk-Board<br>**Websites:** www.ee.nchu.edu.tw |
| **Lecturer No.** | **Topic / Subject to be covered** |

| | |
|---|---|
| 1 | Standardizing SOP equation K – map – 2 Variable – Take simplification with minimum 6 examples |
| | 3 – variable K – map – Simplification with 10 examples |
| 2 | 4 – variable K – map - Simplification with 10 examples<br>Don't – Care Condition |
| 3 | Logical Circuit using basic gates / Universal gates of the above. Simplified Boolean expression using K - map |
| 4 | Simplification of POS equation using K - map |
| 5 | Design of Half Adder,& Full Adder |
| 6 | Design of Half Subtractor, Full Subtractor |
| 7 | Multiplexer – Design using Logic gates |
| 8 | Mux tree, Demux principle |
| 9 | Design of Demux & Demux tree |
| 10 | Decimal to BCD (74147) Priority Encoder<br>Octal to Binary (74148) Priority Encoder |
| 11 | BCD – 7 Segment Decoder (IC 7447) |
| 12 | Digital Comparator (7485) & ALU 74181 |

| | |
|---|---|
| Topic 4 | **Name: Sequential Logic Circuit**<br>**Facts:** Clock Signal, Memory element, 1 bit memory cell, Volatile & Non Volatile Memory<br>**Concepts:**<br>♦ Sequential Logic Circuit<br>♦ Flip flop<br>♦ Counters & Registers<br>♦ RAM, ROM, PROM, EPROM, $E^2$PROM<br>**Principles:** Timing Diagram<br>**Reference Material:** R. P. Jain<br>**Teaching Aids:** Chalk-Board<br>**Websites:** www.hamptonhigh.ca |
| **Lecturer No.** | **Topic/Subject to be covered** |
| 1 | ♦Clock signal Level Triggering , Edge Triggering , Positive edge Triggering and negative Edge Triggering<br>♦Block Diagram of Sequential Logic |
| 2 | Differentiate between Combinational Logic & Sequential Logic<br>1 bit Memory Cell |
| 3 | R – S flip flop & clocked RSFF Working, Truth table & Timing Diagram |
| 4 | J – K Flip flop →Race around, Working condition, Truth table, Timing diagram, Preset & Clear terminals |

| | |
|---|---|
| 5 | MS JK Flip flop, D Flip Flop & T. Flip flop symbol Working, Truth Table, Timing Diagram |
| 6 | Applications of Flip flops<br>• Counter<br>•Asynchronous – 3 bit counter<br>Working<br>Truth table<br>Timing Diagram |
| 7 | Design of 4 bit ripple counter<br>State diagram<br>Truth table<br>Logic Circuit Diagram<br>Timing Diagram<br>Modulus of a Counter |
| 8 | Design of mod N – Counter<br>Excitation table of J-K Flip Flop |
| 9 | Design of Synchronous Counter<br>• State diagram<br>•Truth table<br>•K – map<br>•Reset Logic<br>•Logical Circuit Diagram<br>•Timing Diagram |
| 10 | Registers & Types |
| | •SISO – Circuit diagram, Truth table, Timing diagram |
| 11 | SIPO, PISO Circuit diagram & Truth table |
| 12 | 1) PIPO – Circuit Diagram<br>2) Universal Shift Register IC – 7495 → Pin diagram |
| 13 | Application of Shift Registers<br>•Ring Counter – Circuit Diagram – Truth table<br>•Twisted Ring Counter – Circuit Diagram – Truth table |
| 14 | Memories<br>•Classification<br>•RAM<br>•ROM<br>•PROM<br>•EPROM<br>•$E^2$PROM |

| | |
|---|---|
| **opic 5** | **Name: A – D Converter & D – A Converters**<br>**Facts:** Analog Signal<br>Digital Signal<br>**Concepts:**<br>•Analog – Digital Conversion<br>•Digital – Analog Conversion<br>**Reference Material:** R. P. Jain<br>**Teaching Aids:** Chalk-Board, LCD<br>**Websites:** *www-personal.engin.umd.umich.edu*<br>www.acad.polyu.edu.hk , www.me.gatech.edu |
| **Lecturer No.** | **Topic / Sub topic to be covered** |

| | |
|---|---|
| 1 | ⬧ Need for A – D & D – A Conversion<br>⬧ D – A Converter<br>⬧ Weighted Resistor method – Circuit Diagram Working |
| 2 | Advantages of Weighted Resistor & Disadvantages – DAC Specifications |
| 3 | R – 2R Ladder – Circuit, Working, Advantages & Disadvantages<br>⬧ One or Two Problems on DAC |
| 4 | ⬧ A – D Converter<br>⬧ Quantization<br>⬧ Quantization Error<br>⬧ Ramp method – Block Diagram, Working, Advantages, Disadvantages |
| 5 | Dual Slope method – Block Diagram, Working, Advantages, Disadvantages |
| 6 | Successive approx.. method – Block Diagram, Working, Advantages, Disadvantages<br>⬧ Specification of ADC<br>⬧One or two problems on ADC |

5.2 Planning and Conduct of Test:

| Sr. No | Class Test | Marks | Topics |
|---|---|---|---|
| 1 | Class Test 1 | 25 | • Topic 1, Topic 2, Topic 3.1 till k-Map |
| 2 | Class Test 2 | 25 | • Topic3.1From Multiplexers to end of the chapter. Topic 4. Topic 5 |

5.3 Details about conduct of assignments:

- Assignment no. 1: Give assignment on each topic of curriculum.
- Assignment no. 2: Sample question paper of Digital Techniques to be solved by every student

***[Students should submit the assignments at the time of submission of Physics manual and teacher should check the assignments at the time of submission of*** Digital Techniques ***manual]***

5.4 Strategies for Conduct of Practical:

5.4.2. Suggestions for Effective Conduct of Practical and assessment.

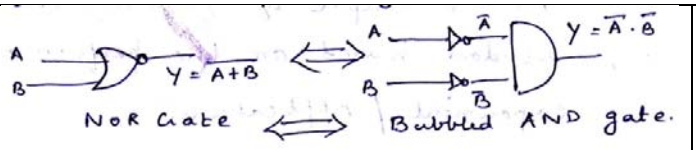
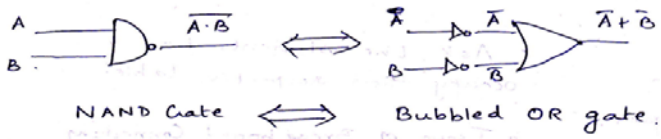
Guidelines for conduct of Practicals.

| Experiment No | Activity | Time |
|---|---|---|
| 2 Verification of Truth table of Logic gates – AND, OR, NOT, NAND, | Kindly arrange to procure ICs corresponding to the various Logic gates mentioned in advance. | |
| | Divide the batch into group of 3 students / as mentioned in the Lab manual and allot a table. | 05 mins |
| | Issue of Breadboard, connecting wires and ICs to | 10 mins |

| | | |
|---|---|---|
| NOR, EX-OR, EX-NOR. | group leader. | |
| | Explain and demonstrate how to make connection on the breadboard. | 10 mins |
| | Explain the pin configuration of the various ICs | 10 mins |
| | Ask the students to write the Truth table of various ICs (gates). | 10 mins |
| | Demonstrate by giving inputs from power supply and observing the output on DMM / LED and verify the truth table. | 10 mins |
| | Ask the students to perform the experiment by giving inputs and measuring the outputs and record the results on the table given in the manual for various ICs provided (gates) | 30 mins |
| | The teacher may clarify doubts if any and ask the students to draw conclusions | 05 mins |
| | Teacher may assign questions to students | 05 mins |
| | Students should return all the equipments to the Instructor. | |
| | Assessment of manual. Ask a couple of questions to each student based on the performance of the experiment / application. | 30 mins |

Note: Within a group each student may be asked to make connections for two ICs so that their motor skills of each student may be assessed.

| Experiment No. | Activity | Time |
|---|---|---|
| **3** Verification of De Morgan's Theorems. | Ask the students to occupy their respective table. | 05 mins |
| | Issue of Breadboard, connecting wires, ICs to group leaders. | 10 mins |
| | Once again reinforce the technique of how connections are made on the bread board. | |
| | Explain the pin configuration of the ICs used for performing the experiment. | 05 mins |
| | Explain the first statement of De Morgan's theorems $\overline{A+B} = \overline{A} \cdot \overline{B}$ & the corresponding circuits | 05 mins |

| | | |
|---|---|---|
| |  | |
| | Ask the students to make connections as shown in the figure or bread board and verify their truth tables. Check whether the outputs of both the circuits are identical for various input conditions. | 20 mins |
| | Explain the second statement of De Morgan's theorem<br>1. $\overline{A \cdot B} = \bar{A} + \bar{B}$ & the corresponding circuits.<br>  | |
| | Ask the students to make connections as shown in the figure on bread board and verify their truth table. Ask the students to check whether the output of both the circuits identical for various input conditions. | 05 mins |
| | Ask the students to record the results in the lab manual. | 05 mins |
| | Make the students to draw conclusions. | 05 mins |
| | Clarify the doubts of students if any | 05 mins |
| | Ask the students to return all the equipments to the Instructor. | 05 mins |
| | Assign questions to students. | 05 mins |
| | Assessment of Manual. Ask a couple of questions to each student based on the performance of experiment / application. | 30 mins |

| Experiment No | Activity | Time |
|---|---|---|
| **. 4** Construction of Half Adder & Full adder. | Ask the students to occupy their respective table. | |
| | Issue of Breadboard, connecting wires, ICs to group leaders. | 05 mins |
| | Explain the circuit of half adder along with truth table. | 05 mins |
| | Ask the students to construct the circuit on the bread board and verify the truth table for sum and carry for various input conditions. | 20 mins |
| | Ask the students to draw conclusions and record the outputs in the lab manual. | 05 mins |
| | Explain the circuit of Full adder along with truth table. | 05 mins |
| | Ask the students to construct the circuit on the bread board and verify the truth table for sum and carry for various input conditions. | 30 mins |

| | | |
|---|---|---|
| | Ask the students to draw conclusion and record the outputs in the lab manual. | 05 mins |
| | Clarify the doubts of students if any | 05 mins |
| | Ask the students to return all the equipments to the Instructor. | 05 mins |
| | Assign questions to students. | 05 mins |
| | Assessment of Manual. Ask a couple of questions to each student based on the performance of experiment / application. | 30 mins |

| Experiment No. | Activity | Time |
|---|---|---|
| **5** Implementation of Combinational circuit using Mux. | Ask the students to occupy their respective table. | |
| | Issue of Breadboard, connecting wires, ICs to group leaders. | 05 mins |
| | Explain the Multiplexer IC and its pin configuration. | 10 mins |
| | Explain how Boolean expressions can be implemented using multiplexer. | 10 mins |
| | Allocate different Boolean expression for implementation to various batches | 05 mins |
| | Ask the students to implement the respective Boolean expressions given to them. | 30 mins |
| | Check the connections made by the students. | 05 mins |
| | Ask the students to verify the truth table. | 05 mins |
| | Ask students to draw conclusion and record the outputs in Lab manual. | |
| | Clarify the doubts of students if any | 05 mins |
| | Ask the students to return all the equipments to the Instructor. | 05 mins |
| | Assign questions to students. | 05 mins |
| | Assessment of Manual. Ask a couple of questions to each student based on the performance of experiment / application. | 30 mins |

## 6. Mode of assessment

6.1 Class Test Schedule ( As per MSBTE ):

- It is proposed that there will be two tests each of 25 Marks.
- The tests will be conducted as per the MSBTE Schedule.
- Teacher should prepare model answer of class test question papers.
- Teacher should show the answer papers of class test to the students and maintain the records as per MSBTE norms.

6.1.1 Guidelines for Setting Class Test Question Paper:

Question No 1 : Attempt any three out of four (3 x 3=9 Marks)

Question No 2 : Attempt any two out of three (2 x 4=8 Marks)

Question No 3 : Attempt any two out of three (2 x 4 =8 Marks)

6.1.2. **Sample Question Paper:**

## Sample Question Paper Class Test 1

**Course Name: Computer Engineering Group**

**Course Code: CO/CM/CD/IF/CW** **Semester: THIRD**

**Subject:- DIGITAL TECHNIQUES** **Subject Code 17333**

**Marks:- 25** **Hours: 1 Hr**

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**QI) Attempt any THREE: (3x3)** **9 Marks**

a) Define
   i) Propagation delay
   ii) Fan-in
   iii) Fan-out

b) Convert the following:
   i) $(42)_{10} = (?)_2$
   ii) $(67)_8 = (?)_2$
   iii) $(1101011)_2 = (?)_H$

c) Draw the symbol, logical Expression & truth table of the following gates.
   i) AND gate
   ii) Ex – OR gate

d) Design anHalf Adder circuit with truth table, K – map and logical circuit diagram.

**QII) Attempt any TWO: (2x4)** **8 Marks**

1) Compare TTL & CMOS logic families on the basis of
   i) Propagation delay ii) Fan-in iii) Fan-out iv) Power dissipation.
2) State and prove De Morgan's theorem.
3) Reduce the following Boolean expression using K – map.
   $Y = \Sigma\, m_0, m_2, m_4, m_6, m_8, m_9, m_{10}, m_{12}, m_{13}, m_{14})$
   Draw the logical circuit diagram of the simplified expression using basic gates

**Q3) Attempt any TWO: (2x4)** **8 Marks**

1) Subtract using 1's Complement & 2's complement method.
   $(110100)_2 - (111000)_2$

2) Draw the logical circuit diagram of AND, OR, NOT & NOR gates using NAND gates.
3) Simplify the following Boolean expressions.
   i) $Y = AB + A.\overline{B} + B\overline{C}$
   ii) $Y = AB + B(\overline{B}+C) + A\overline{B}$

## Sample Question Paper Class Test II

**Course Name: Computer Engineering Group**

**Course Code: CO/CM/CD/IF/CW** **Semester: THIRD**

**Subject:- DIGITAL TECHNIQUES** **Subject Code:-17333**

**Marks:- 25** **Hours: 1 Hr**

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**Q1) Attempt any THREE: (3x3)** **9 Marks**

1) State the need for multiplexers. Draw the block diagram of 4:1 Mux.
2) Differentiate between combinational logic & Sequential logic circuits (any 3 points).
3) Draw a clock signal and explain positive edge triggering & negative edge triggering.
4) Define the following specifications of A – D convertor
   a) Quantization noise b) Conversion Time c) Resolution

**Q2) Attempt any TWO: (2x4)** **8 Marks**

1) Draw the block diagram of BCD to 7 – segment decoder/ driver and draw its truth table. Give the function of Lamp Test and Ripple Blanking input pins.
2) What is Race- around condition in JK flip flop and how it can be eliminated?
3) Draw the logical circuit diagram of 3 – bit ripple counter and draw its timing diagram showing clock and outputs of each flip Hop.

**Q3) Attempt any TWO: (2x4)** **8 Marks**

1) Draw the circuit diagram of weighted resistors method of D-A converter and describe its working.
2) Draw the logical circuit of serial-in serial-out shift register. Explain with Truth table.
3) a) Describe the significance of Preset& Clear terminal in J-K flip flop
   b) Convert S-R flip flop into D- flip flop and explain the working.

6.2. 2 QUESTION PAPER ROFILE:

**6.2.3 Sample Question Paper:**

# Sample MSBTE Question Paper

**Course Name: Computer Engineering Group**

**Course Code: CO/CM/CD/IF/CW** **Semester: THIRD**

**Subject ::- DIGITAL TECHNIQUES** **Subject Code :-(17333)**

**Marks:- 100** **Hours :- 3 Hrs**

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SAMPLE PAPER FOR DIGITAL TECHNIQUES – 17333 (Third Semester)

**QI) (A) Attempt any SIX: (6x2)** **12 Marks**

a) Define with respect to digital ICs
   i) Propagation delay
   ii) Noise immunity
b) What is positive logic with respect to a digital signal?
c) Draw the logical symbol, Truth table, and logical expression of AND gate.
d) State any four Boolean Laws.
e) Solve the following:
   a) $(110101)_2 + (101101)_2$
   b) $(1010)_2 - (1000)_2$ using 1's complement method.
f) Draw the symbol, logical expression and truth table of 3i/p OR gate.
g) Draw the truth table of digital comparator IC 7485.
h) Define the following with respect to DAC
   i) Resolution
   ii) Settling time.

**QI) (B) Attempt any TWO (2x4)** **8 Marks**

a) Convert the following
   i) $(212)_{10} = (?)_2$
   ii) $(11010)_2 = (?)_{10}$
   iii $(436)_8 = (?)_2$
   iv) $(206)_8 = (?)_H$
b) State and prove De Morgan's theorem.
c) Perform the following BCD arithmetic.
   i) $(247)_{10} + (463)_{10}$
   ii) $(42)_{10} - (27)_{10}$

**QII) Attempt any FOUR: (4x4)** **16 Marks**

a) Implement AND & OR gates using NAND gates only.

b) Given $Y = A\overline{B} + \overline{BC} + \overline{A}C$

   Implement the logical expression using gates.

c) Perform the following binary operation
   i) 11010 × 1011

ii) 11011 ÷ 110

d) Design a Half Adder Circuit.

e) Minimize the following Boolean expression using K – map.
$Y = \Sigma\, m_1, m_3, m_5, m_7, m_{10}, m_{11}, m_{14}, m_{15}$. Draw the logical circuit diagram of minimized expression using basic gates

f) Draw the block diagram of Decimal to BCD encoder IC 74147 and describe its working with truth table.

**QIII) Attempt any FOUR: (4x4) 16 Marks**

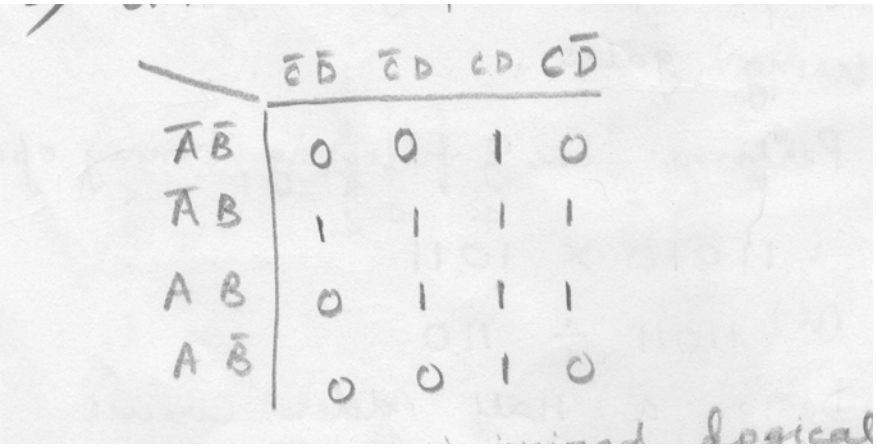
a) Simplify the following Boolean Expression using Boolean laws.

i) $Y = \overline{A}B + ABD + A\overline{B}C\overline{D} + BC$

ii) $Y = A + \overline{A}B + \overline{A}\,B\,C + \overline{A}\,\overline{B}\,C\,D$

b) Draw the logical block diagram of 4:1 multiplexers and describe its working. Give the expression for the output and draw the circuit diagram using gates.

c) Given K-map




Write the minimized logical expression and draw the logical circuit using universal gates.

d) Standardize the following Boolean expression

i) $Y = AB + \overline{B}C + A\overline{C}$

ii) $Y = (A+C)\ (B+\overline{C}) + (\overline{A}+B)$

e) Draw the logical circuit diagram of clocked SR flip flop using NAND gates and describe its working with truth table.

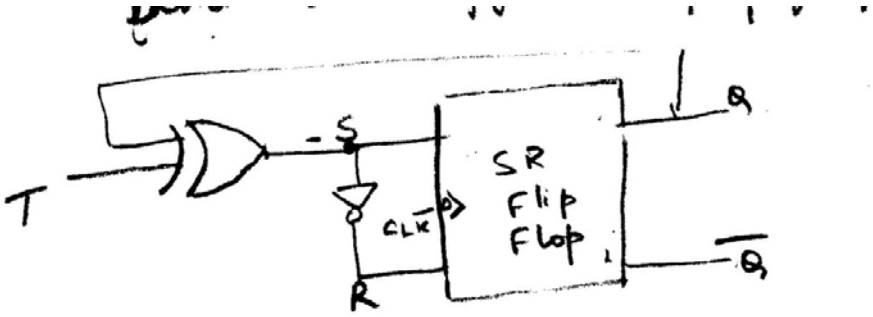
f) Draw the logical circuit diagram of a 3 bit asynchronous UP Counter. Describe its working with timing diagram.

**QIV) Attempt any FOUR: (4x4) 16 Marks**

a) What is modulus of a counter? Show the method to determine the number of flip flops for a mod – 46 Counter?

b) Give 2 advantages and 2 disadvantages of A – D Converters.

c) Prepare the truth table for the given logical Circuit diagram and from the truth table identify the flip flop.




d) Explain the significance of Preset& Clear terminals with truth table of JK Flip flop.
e) Classify memories. What are the mechanisms used for erasing EPROM.
f) Draw the block diagram of successive approximation method of A-D Converter & describe its working.

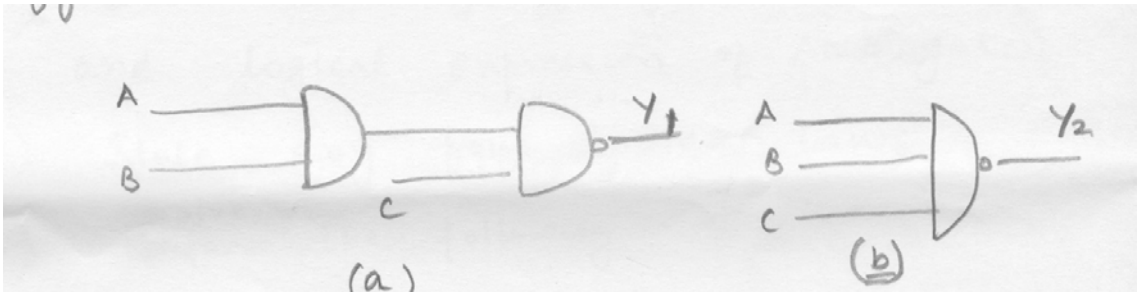
**QV) Attempt any FOUR: (4x4) 16 Marks**

a) Perform the following Subtraction using 2's complement method
   i) 1000 – 01001
   ii) 11100 – 00011
b) Draw the block diagram of Sequential logic and state the importance of clock signal in it.
c) Given logical equation
   $Y = (A+BC)(B+\overline{C}A)$
   Design a circuit using basic gates to realize this function.
d) Draw the circuit of a ring counter and describe with timing diagram.
e) Draw the block diagram of BCD – 7 segment decoder / driver. Describe its working.
f) Draw the logical circuit diagram of PISO shift register. Describe its working.

**QVI) Attempt any TWO: (2x8) 16 Marks**

**A)** i) State the applications of de multiplexers. (2 marks )
ii) Design 16:1 multiplexer using 4:1 multiplexers only. (6 marks)

**B)** i) Determine the output of the following figures and shows that $Y_1 = Y_2$.(2 marks)




ii) State two applications of shift registers. (2 marks)
iii) Design a mod 5 asynchronous counter. (4 marks)

**C)** i) Draw the Circuit diagram of R – 2R Ladder method of D – A Converter and describe its working.(4 marks)

ii) A D/A converter has a full scale analog o/p of 10 V and accepts 4 binary bits as inputs. Find the Voltage Corresponding to each analog step.(4 marks)