CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

Programming in 'C'

(17212)

Scheme - G

SECOND SEMESTER

DEC 2012

MAHARASHTRA STATE
BOARD OF TECHNICAL EDUCATION, Mumbai

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.

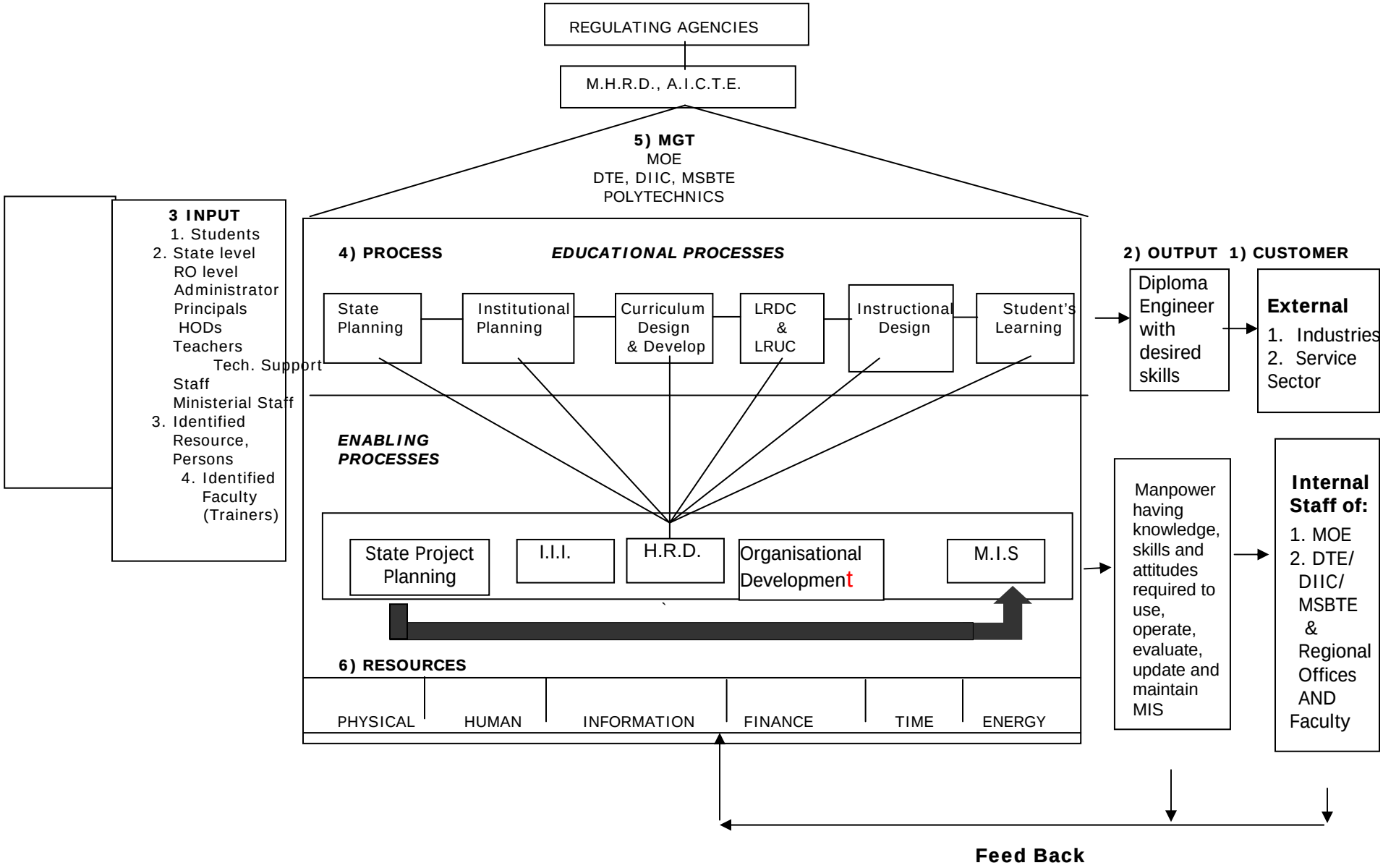


Fig 1 Systems Approach

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:

- Search information from various sources
- Develop communication ability
- Develop Presentation skill
- Work as a member of a team/group and as leader
- Collect field data
- Develop Learning to learn
- Write report for given task/work/project
- Develop computer proficiency
- Develop observation skills

Technological Skills:

Diploma engineers should possess following Technological skills in order to satisfactorily perform duties assigned to them:

Intellectual skill:

1. Identify the problem
2. Prepare the algorithms
3. Analyze the problem
4. Prepare the flowchart/model
5. Select hardware and software tools and technologies
6. Use of appropriate programming languages
7. Write program
8. Test and debug computer Program
9. Diagnose the hardware faults

10. Prepare and interpret software documentation
11. Manage/administer the computer system/Network system

Motor skills:

1. Handle the Computer system
2. Handling trouble shooting tools
3. Assemble and disassemble computer system
4. Install hardware devices
5. Install network

1.5 Salient Changes in the curriculum:

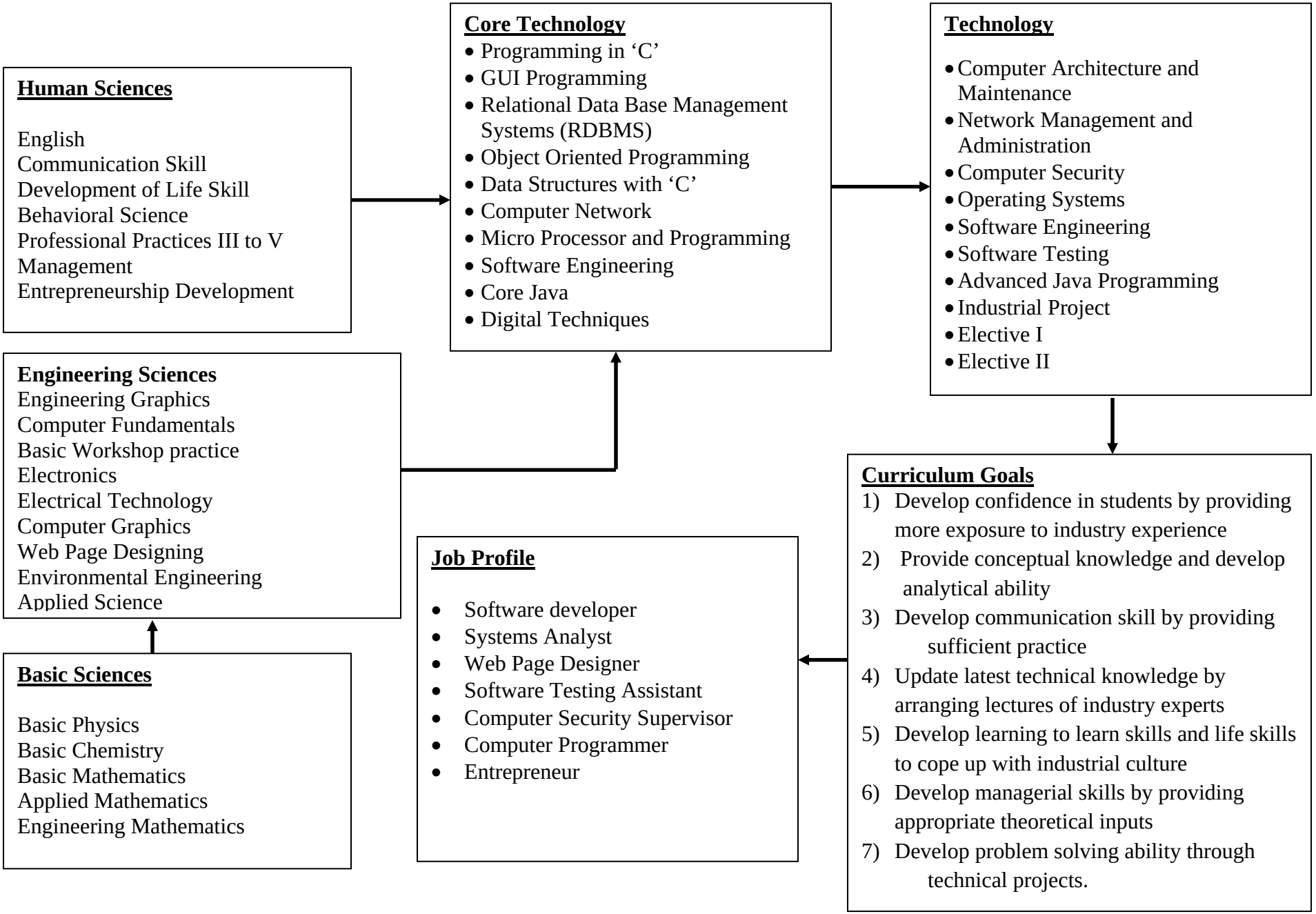
- For First Semester Basic Science is divided into two parts- Basic Physics and Basic Chemistry. Theory examination of both parts as well as practical examination of both parts will be conducted on separate days. Sum of theory marks of both parts shall be considered for passing theory examination of Basic Science. Similarly it is applicable to practical examination. It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- For second semester Applied Science is divided into two sections- Applied Physics and Applied Chemistry where the theory examination of 50 marks each and practical examination of 25 Marks each will be conducted separately and the minimum passing marks for Engineering Science will be the combination of both the sections. . It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- The components of Development of Life Skills were taught in two semesters. In Development of Life Skills –I the topics related to personal

development, such as Learning to Learn Skills, personality development, presentation skills etc. were included. In Development of Life Skills – II the topics related to Team Building, Leadership, group behavior etc. were covered. In the revised curriculum the scope of development of life skills has been broaden to include behavioral science component. Therefore the subject Development of Life Skills – II has been renamed and it is now included at Vth Semester in the revised curriculum under the title Behavioral Science.

- The subject of Professional Practices was introduced to integrate the skills acquired in Development of Life Skills, through technical subjects from second to sixth semester. The experience in implementing the contents of the subject shows that there are limited activities possible in second semester as the technical knowledge given to the students is very limited. Also at sixth semester the student are doing projects in which they are performing many activities included in the Professional Practices and therefore it is proposed that the subject of Professional Practices be prescribed only for three semesters vis. Third, fourth and fifth semesters.
- Introduction of Environment Engineering at fourth Semester for all courses
- From the experience of implementation of Elective Subjects at V and VI semesters in last five years, it is proposed to have only one elective either at the fifth and sixth semesters for all courses. However the specialized courses like Medical Electronics, Electronics and Video Engineering will not have provision for electives. For elective, student will have to choose one from the given two/three subjects.
- While revising the curriculum redundant /obsolete topics/sub topics are being replaced by new/advance technology topics/sub topics.
- In Mechanical Engineering Group CADD, 3D Modeling, CNC Machines, Engine Maintenance (AUTO) are introduced as independent subjects.

- In Civil Engineering Group CAD has been added as an independent subject.
- In Electronics Engineering Group simulation software has been introduced, weightage of Microprocessors is reduced and more weightage is given to Microcontrollers, topics on PLC and SCADA are added, contents of discrete circuits are reduced and emphasis is given on integrated circuits.
- In Electrical Engineering new topic of LED lighting has been added in Illumination Engineering subject. Similarly introduction of residential solar lighting systems, topics like duties and responsibilities of Electrical Inspector, Commercial aspects of power utilities have also been added. Heating, Ventilation & Air-conditioning (HVAC) has been deleted from the revised curriculum. Subject of Power System Operation has been introduced at VI Semester Electrical Course also.

1.6 LINK DIAGRAM for Computer Engineering / Computer Technology:



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

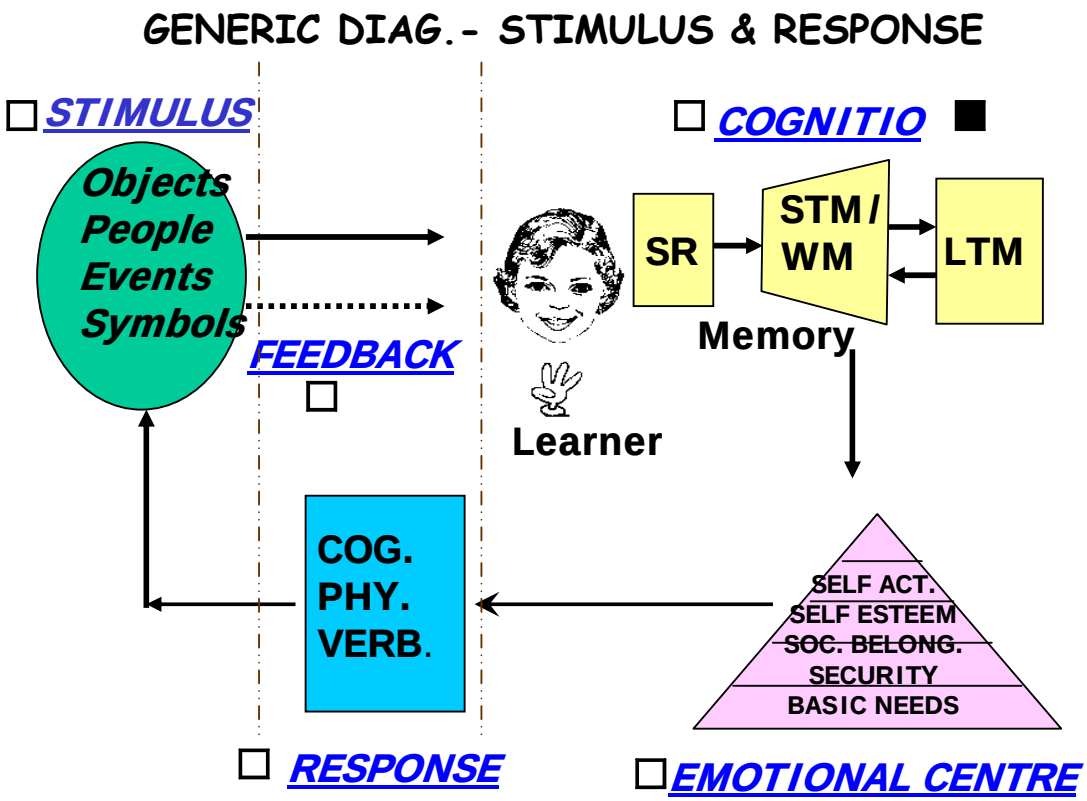


Fig. 2: Generic Diagram of Learners.

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.

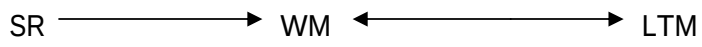
Response: When stimulus stimulate the learner reacts. This response may be mental response like reflection of face (cognition), physical movement (motor skills) or verbal response like communication. The response always aims at changing the stimulus situation.

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.

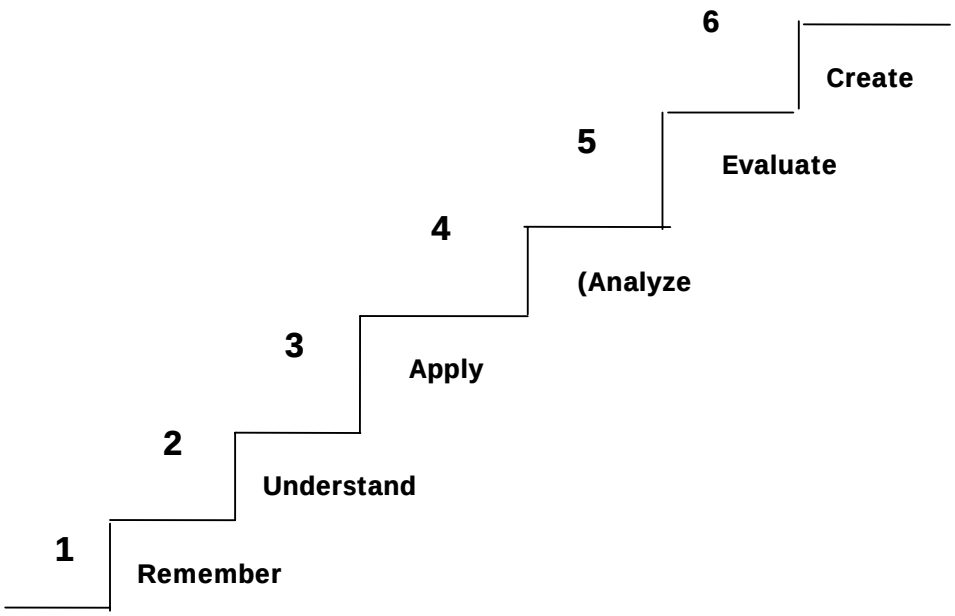
2.4 LEVELS OF LEARNING:

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	Knows common terms, specific facts, basic concepts, principles, methods & procedures	Define, describe, identify label, list, match, name, outline, reproduce, select, state

domain		
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 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.	Applies principles to new situations. Applies theories to practical situations. Solves mathematical problem. Construct charts, graphs Demonstrates correct usage of a procedure	Change, compile, demonstrate, discover manipulate, modify 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 categorized 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, organized 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 Dimension	COGNITIVE PROCESS 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 understands and effectively learns 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 indicates the scope of the subject.

Objectives indicate what is achievable and hence gives direction to 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 studying 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 Meta cognitive. 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. Therefore 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

3. 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 organized 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 analyzed here at a micro level.

Before we begin actual teaching of any topic (lesson), we must carefully and critically analyze 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 curriculum, 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 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 emphasized 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 analyzing 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/CD/CM/CW/IF

Semester : Second

Subject Title : Programming in 'C'

Subject Code : 17212

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	04	03	100	25#	--	25@	150

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:

In today's information technology era, computer technology plays an important role. Computer applications are all pervasive in day to day life of human being. It become compulsory to all employable to have sound knowledge of how computer works and process data and information.

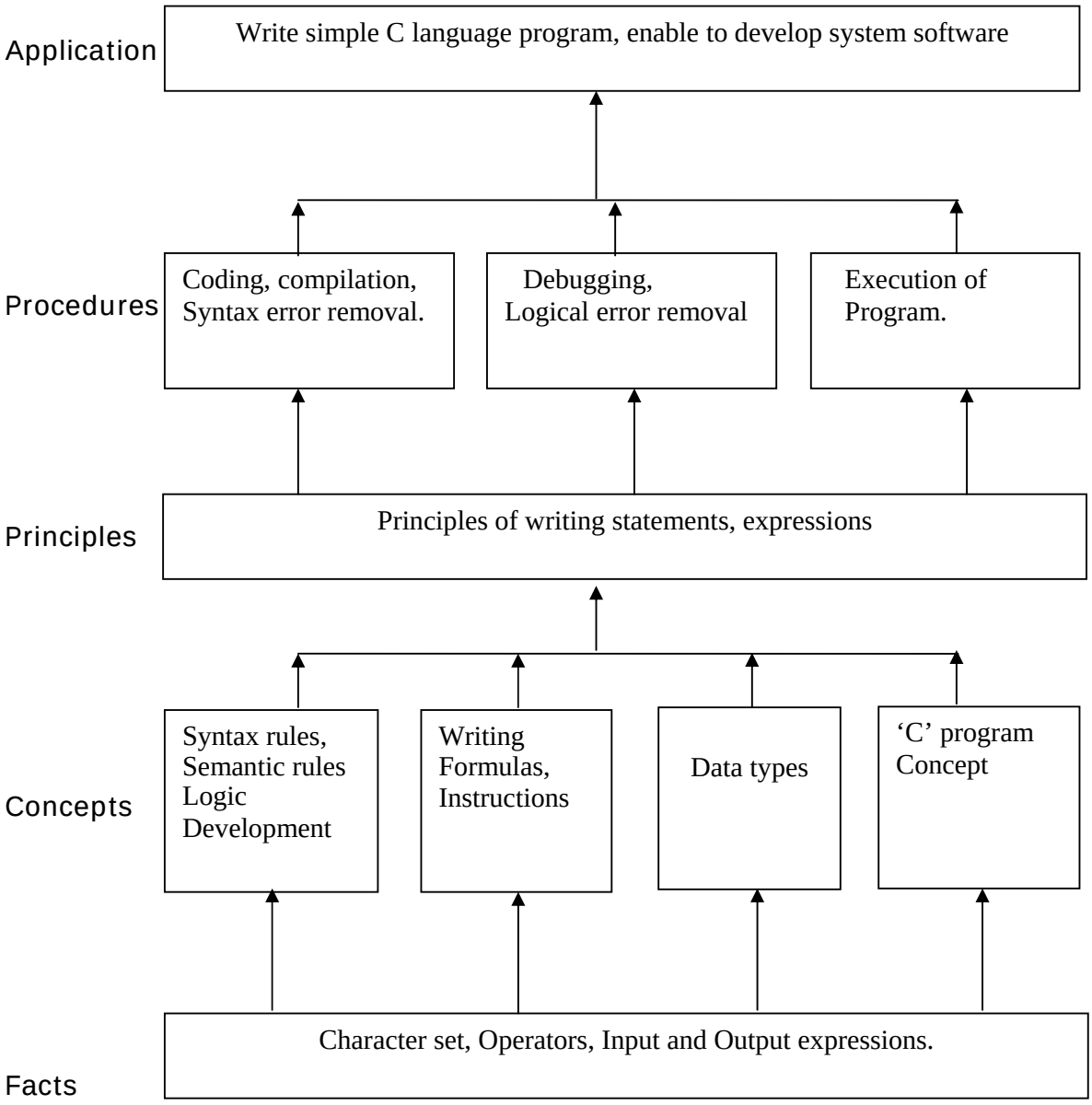
'C' is the most widely used computer language, which is being taught as a core subject. C is general-purpose structural language that is powerful, efficient and compact, which combines features of high-level language and low-level language. It is closer to Man and Machine both. Due to this inherent flexibility and tolerance it is suitable for different development environments. C is still considered as first priority programming language.

This subject covers from the basic concept of C to pointers in C. This subject will act as "programming concept developer" for students. It will also act as "Backbone" for subjects like OOPS, VB, Windows Programming, JAVA, OOMD, etc.

General Objectives: The students will be able to

- Understand the concepts of constants, variables, data types and operators.
- Write algorithm and draw flowchart for a given problem statement.
- Develop programs using input and output operations.

Learning Structure:



Theory:

Topics and Contents	Hours	Marks
Topic 1: Basics of C **Specific Objectives: -** ➢ State rules for declaration of variables, constants and operators ➢ Write simple program using formatted input and formatted output. **Contents:** ➢ History of C, where C stands ➢ C character set, tokens, constants, variables, keywords , identifiers ➢ C operators- arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special, operator precedence, C expressions data types ➢ Problem solving techniques : flowchart and algorithm ➢ Formatted input, formatted output instructions.	**08**	**18**
Topic 2: Decision making **Specific Objectives: -** ➢ Write a simple program using decision making, branching statement, looping statement ➢ Describe use of break and continue statement. 2.1Decision making and branching if-statement – if, if-else, else-if ladder, nested if else, switch case statement, break statement **(14M)** 2.2 Decision making and looping - while, do, do- while statement , for loop, continue statement **(14M)**	**10**	**28**
Topic 3: Arrays and Strings **Specific Objectives: -** ➢ Give syntax of single dimensional, multidimensional array and strings. ➢ Write a program using array and string. 3.1Arrays Declaration and initialization of one dimensional, two Dimensional and character arrays, accessing array elements. **(10M)** 3.2 Declaration and initialization of string variables, string handling functions from standard library – strlen(), strcpy(), strcat(), strcmp() **(08M)**	**10**	**18**

Topic 4: Functions and Structures **Specific Objectives: -** ➢ State the scope of local and global variable. ➢ Understand the category of function call and function type and write program. ➢ Write and execute the program using command-line argument. ➢ Write a program using structure		
4.1 Functions: - Need of functions, scope and lifetime of variables, defining functions, function call, call by value, call by reference, return values, storage classes. category of function - No argument No return value, No argument with return value, argument with return value, recursion, command line arguments **(16M)** 4.2 Structures: - Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure. **(8M)**	**14**	**24**
Topic 5: Pointers **Specific Objectives: -** ➢ State the declaration syntax of pointer, pointer initialization ➢ Write the program using pointer arithmetic Understanding pointers, declaring pointer variable, initialization of pointer variable, accessing address of a variable, pointer expressions, Pointers arithmetic	**06**	**12**
Total	**48**	**100**

Practical:

Skills to be developed**:**

Intellectual skills:

- Use of programming language concepts in program implementation.
- Apply appropriate logics to solve given problem.
- Write program using different implementations for the same problem
- Identify different types of errors as syntax semantic, fatal, linker & logical
- Debugging of programs

Motor skills:

- Proper handling of Computer System**.**

List of Practical: At least 4 sample programs on each title

Demo Lectures with power point presentations using LCD projector can be arranged to develop programming concepts of students.

Sr. No.	Title of Experiment	Hours	Programs
01	To draw flowchart and write algorithms for sample program	02	04
02	To write a C program for formatted input and output statements	04	02
03	To write a C program for various operators in 'C'	06	02
04	To write a C program for decision control with if else statements	06	03
05	To write a C program for decision control with switch case statement	06	03
06	To write a C program for Looping statements	08	04
07	To write a C program for single dimensional integer arrays	06	02
08	To write a C program for string functions,	08	02
09	To write a C program for recursive functions	04	02
10	To write a C program using structure	06	02
11	To write a C program for pointers to print values of variables and their addresses	04	02
12	To write a C program to demonstrate the concept of pointer arithmetic.	04	02
13	To write a C program for command line arguments in 'C'.	04	02

Learning Recourses:

1. **Books**

Sr. No.	Name of Book	Author	Edition	Publication
1	Let us 'C'	Kanetkar	3rd	BPB
2	Programming in 'C'	E. Balgurusamy	5th	Tata Mc-Graw Hill
3	C for beginners	MadhusudanMothe	1st	SPD

2. **Websites:**

- http://cplus.about.com/od/beginnerctutoriali/a/blctut.htm
- http://computer.howstuffworks.com/c.htm
- http://www.java2s.com/Tutorial/C/CatalogC.htm
- http://www.cprogramming.com/tutorial.html
- http://www.indiastudycenter.com/studyguides/sc/objtest/default.a

5. IMPLEMENTATION STRATEGY:

Common guidelines for effective teaching:

- Describe learning structure of the subject to the students at the start of semester in brief.
- Prepare own subject notes.
- Refer concept structure of every topic.
- Encourage students to write the programs in lab manual / lab note-book.
- Ensure that syntaxes are properly practiced.
- Do not dictate programs.
- Emphasis on developing algorithm for every program.
- Insist students to bring relevant study material along with lab manual while coming for practicles.
- Give the relevance of each topic with real life applications such as Railway, Bus Reservation system, Electricity Bill generation.

- 5.1 Planning of Lectures for a Semester with Content Detailing:

Topic I	**Name: Basics of 'C'**
	Facts: C programming Language, character Set, Operators, Keywords, Instructions, Input and Output expressions **Concepts:** **-**Turbo C editor, -Programming Language Levels -Program development steps -syntax Rules, Semantic rules **Principles:** Principles of writing statements, expressions - Algorithm, - flowcharts - Steps for execution of program **Reference Material:** **Teaching Aids:** Black board, Chalk, Transparencies, Power point presentation slides(PPTs), Reference books, notes, LCD projector/OHP Projector, **PPT with Sample: Preferably prepare PPTs containing-** **--**Character Set, Operators, Keywords, Instructions, Algorithm, Flowchart, C Programming environment (TC editor), Sample example program. **Websites:** • www.cprogramming.com\tutorial.html • http://en.wikipedia.org/wiki/Comparison_of_programming_languages • **http://c.ihypress.ca/ suggested best link to surf**

Lecture No.	Topic / Subtopic to be covered	Programming in 'C'	Let us 'C'	C for Beginners-SPD
1	• History of 'C' (ALGOL/ADA, CPL, BCPL ,B, C) • Programming language basics • Low level and High level Programming language • Features of 'C', Middle level Language • 'C' programming environment, • Turbo 'C" version 2.0 onwards (preferably Turbo C version 3 -C++) • Steps in Program development, • Review of Flow chart(symbols), algorithm, Program and their relationship, • Functions performed by Compiler, Linker	Page 1 to 15	Page 1 to 5 and 22 to 28	
2	• C character set – Concept of Characters • Char and its ASCII codes, (Show ASCII Table in class) • Alphabets, Numeric, Punctuation, Space and Control characters (Identify from the ASCII table shown)	Page 22 to 23	Page 5 to 22	
3	• Tokens: Meaning of Token in Programming, Forming a token, • Rules for tokens in 'C', • Constants: Numeric, Character, String • Concept and definitions for Variables, • Concept of keywords and identifiers, • Multiple Examples for each. Variable and memory.	Page 24 to 30	Page 23 to 29	
4	• C operators: Arithmetic Operators: +, -,*, /, o Arithmetic expressions examples. • Concept of unary, binary and ternary operators • Relational operators: <, >, <=, >=, ==, !=. Conditional expressions. Result as True and False, ? : operator. • Logical operators: AND - &&, OR- ||, NOT - !,.,Result as True and False, using Multiple conditions, Examples.	Page 52 to 75	Page 38 to 60	Chap-02

	Evaluate the expression			
5	• Assignment, Lvalue and RValue, =, +=, -=, *=, /= operators and its mathematical expressions. • Increment and Decrement: ++, -- • Pre and Post increment and decrement operator executions. • Bit wise operator: Binary representations of numbers. &, |, ! Operators and demonstration f the bit wise operators with examples. • Special operator: dot (.) • Need of precedence, • Precedence of operators in C • Overriding the precedence using parenthesis.			Chap -02
6	• Data types in C: Basic data type - int, char, short, float, double, pointer. Number of bytes • Memory requirement, Range of values for each type. Concept of string.	Page 30 to 51	Page 7 to 20	
	• Statements in C Program, Types of statements, • Program structure, main statement and its importance. (Executable, non-executable statements) • Basic input/output statements- printf, scanf. Formats string for I/O statements - %d, %f, %c, %s, %o, %x, etc. • Formatted input and output- Left and right justification specifications, width specifier e.g. %4d, %7.2f, %6s etc. • Putting it all together and writing a small sample programs performing I/O, some arithmetic operations, Apply formats to outputs.	Page 82 to107	Page 23 to 29	
7	• Awareness of usage of 'C/C++' editor and its menus, options, and required steps • Editor-typing C program. • Compiler- finding and rectifying	Use Turbo C / C++ user manual for detail description of editor		

	syntax errors. • Linker necessary linkage of inbuilt functions, header and library files from, -Debugger program for errors (if any), • Execution of above sample programs to verify desired output(Demonstrate it)			
8	Revision			
Lecture No.	**Topic/ Subtopic to be covered**	**Programming in 'C'**	**Let us 'C'**	**C for Beginners-SPD**
1	2.1 Decision making and branching • Decision making and branching – flow of program execution-stepwise execution for small sample program. • Need of decision making • Use of relational operators in decision making and branching	Pg 112-142	Pg 38-50	Chap-02
2	• Type of branching: • If statement • If-else Above points should be covered with respect to following points: Concept structure, Syntax, illustration with example, Sample program.			
3	• Else-if ladder • nested if-else Above points should be covered with respect to following points: Concept structure, Syntax, illustration with example, Sample program.			
4	• Switch-case Above points should be covered with respect to following points: Concept structure, Syntax, illustration with example, Sample program.			
5,6	**2.2** Decision making and looping Need of looping. C looping structures/statements – • do • while • do-while Above points should be covered with respect	151-172	72-95	Chap-03

	to following points: Concept structure, Syntax, illustration with example, Sample program.			
7	• for loop, Above points should be covered with respect to following points: Concept structure, Syntax, illustration with example, Sample program			
8	• nested for loop Above points should be covered with respect to following points: • Concept structure, Syntax, illustration with example, Sample program.			
9	• Illustration of break and continue statements and • Illustration with example with concept structure.			
	• Differences between for, while-do, do-while loop structures on the basis of concept structure, syntax, initialization			
10	Revision			
Topic 3	**Name: Arrays and Strings**			
	Facts: Data types, Operators, Input and Output expressions. data structures **Concepts:** 'C' program Concept -Arrays -Strings -types of arrays **Principles:** - Coding, compilation, Syntax error removal. - Debugging, Logical error removal - Execution of Program. **Reference Material:** **Teaching Aids:** Black board, Chalk, Transparencies, Power point presentation slides(PPTs), Reference books, notes, LCD projector/OHP Projector, **PPT with Sample: Preferably prepare PPTs containing-** Concept structure, Syntax and initialization of:- One dimensional array, two dimensional array, And Different string functions Example program for each concept(may be combined program)			

	Websites: • www.cprogramming.com\tutorial.html • http://en.wikipedia.org/wiki/Comparison_of_programmi • **http://c.ihypress.ca/ suggested best link to surf**			
Lecture No.	**Topic/ Subtopic to be covered**	**Programming in 'C'**	**Let us 'C'**	**C for Beginners-SPD**
1	**3.1** Arrays: • Definition of array, • Declaration of array in C. • Type of values/elements. • Graphical representation of the array and elements,	192 to 217	214 to 220, 233 to 241	Chap-05
2,3	• One dimensional Array Above points should be covered with respect to following points: Concept structure, Syntax, initialization, assessing array elements, illustration with example, Sample program. • Using multiple arrays in same program with data types.			
4	• Two dimensional Array Above points should be covered with respect to following points: Concept structure, Syntax, initialization, assessing array elements, illustration with example, • Sample program.			
6	***3.2*** Character arrays and strings. • Declaration and initialization of string variables. • String functions from standard library of C. • strlen(), strcpy() functions. • Program using these functions.	237 to 261	268 to 281	Chap-08
	• strcat(), strcmp() functions. • Program using these functions.			
7,8	• Implementation of small programs for different string functions without using standard library functions • Program for Copy string, • Program for String concatenation without using standard library			

9	• Implementation of small programs for different string functions without using standard library functions • Program for string compare, • Program for Reverse a string without using standard library.			
10	Revision			
Topic 4	**Name: Functions and structures**			
	Facts: data type, parameters, return values, structure members **Concepts:** -function -structure **Principles:** - Function definition, function prototype , Function call, structure declaration, accessing Structure elements. **Reference Material:** **Teaching Aids:** Black board, Chalk, Transparencies, Power point presentation slides(PPTs), Reference books, notes, LCD projector/OHP Projector, **PPT with Sample: Preferably prepare PPTs containing-** Concept structure, Syntax and declaration of:- Function -user defined function, -in-built function , -Structure Example program for each concept(may be combined program) **Websites:** • www.cprogramming.com\tutorial.html • http://en.wikipedia.org/wiki/Comparison_of_programming_languages • **http://c.ihypress.ca/ suggested best link to surf**			
Lecture No.	**Topic/ Subtopic to be covered**	**Programming in 'C'**	**Let us 'C'**	**C for Beginners-SPD**
1	**4.1** Functions: • Concept and definition, • Need of functions in programming	Pg 270 to 313	Pg 122 to	Chap-04

	• Inbuilt functions-examples • User defined functions. • Sample programs using Inbuilt functions such as sin(), cos(), log() etc.		140, 150 to 156	
2,3	• User defined function: cover it with respect to Concept structure, Syntax, • Function definition, • Function prototype, • Function call, • Illustration with example, • Sample program. • Concept of Parameters to function and return value from function			
4	• Local Variables and Global variables • Scope and lifetime of variables • Formal parameters and Actual parameters.			
5,6	• Parameter passing techniques : call by value, call by reference. • Programs using functions with call by value and call by reference parameters and also with examples return values.			
7	• Storage classes • Category of function			

8	• Recursion
	  • Concept of recursion,
	  • Writing recursive function,
	  • Execution of recursive function with sample recursive functions such as Factorial, GCD, Fibonacci series etc.			

9	**4.2** Structures • Concept of structure, record. • Definition • Need of structure. • Defining structure in C, • Member/field of structure, • Calculating Memory requirement for structure (sizeof())	**324 to 347**	**290 to 307**	Chap-06
10,11	• Declaring structure, • Initialization of structure, • Accessing structure member/field			

	with dot (.) operator. • Sample Program using structure.			
12,13	Arrays of structure- • Declaring array of structure, • Accessing elements of array and members of structure in array. • Program using arrays of structures.			
14	Revision			
Topic 5	**Name: Pointers**			
	Facts: Character set, Operators, Input and Output expressions, data type **Concepts:** -Pointers -Pointer variables **Principles:** - pointer syntax, - Declaration of pointer variables, - Initialization of pointer variables, - Pointer arithmetic **Reference Material:** **Teaching Aids:** Black board, Chalk, Transparencies, Power point presentation slides(PPTs), Reference books, notes, LCD projector/OHP Projector, **PPT with Sample: Preferably prepare PPTs containing-** Example program for each concept(may be combined program) **Websites:** • www.cprogramming.com\tutorial.html • http://en.wikipedia.org/wiki/Comparison_of_programming_languages • **http://c.ihypress.ca/ suggested best link to surf**			
Lecture No.	**Topic/ Subtopic to be covered**	**Programming in 'C'**	**Let us 'C'**	**C for Beginners-SPD**
1	**5.1** Pointers • Concept of memory content and address. • Understanding pointers type	Pg 357 to 385	Pg 140 to 157	Chap-07
2	• Declaring and accessing pointers, • *, & operators			
3	• Memory requirement for pointer variable. • Examples of simple program using pointers			

4	• Pointers arithmetic - addition and subtraction • Pointers arithmetic – increment and decrement • Sample programs on pointer arithmetic			
5	• Use of pointers in function calls and return values			
	• Programs using functions and pointers			
6	Revision			

5.2 Planning and Conduct of Test:

- Question paper shall be as per the MSBTE, Norms.
- The schedule of the test and portion shall be declared in advance.
- It is proposed that there will TWO tests each of 25 marks. The tests will be conducted as per MSBTE schedule.
- Question paper for first test should be based on 40% of the curriculum of the subject and Second test on 40% of remaining curriculum.

5.3 Details about conduct of assignments:

It is suggested that:

- Teacher shall assign chapter wise assignments to students.
- Teacher shall check assignments and provide suggestions for improvement.

5.4 Strategies for Conduct of Practical:

5.4.1 Approach for design of Manual:

- The experiments included shall help students to develop their motor and intellectual skills.
- Teacher shall focus on the grid table and understand the skills to be developed among the students through the performance of particular experiment.
- The new concepts based on prior concepts and the concept structure, which links with the content, shall be explained by the teacher.
- Each concept shall be explained by teacher with proper syntax and example.
- Questions given at the end of experiment in the manual shall be discussed thoroughly, if required additional questions shall be introduced.

5.4.2 Suggestions for effective conduct of practical and Assessment:

Conduct of Practical:

- A separate note book shall be used for practical session.
- Subject teacher shall first give the overview of the experiment.
- Explain the concepts with syntax and example.
- Students shall be instructed to go through the experiment in advance, which is scheduled on the day.
- Teacher shall explain the prior concepts, new concepts and the concept structure to the students before starting the experiment.
- The teacher shall schedule the experiments date wise and display the same in advance.
- More programming illustration can be exercised by student to practice programming under the guidance of teacher/Laboratory assistant.

Assessment:

- The continuous assessment i.e. weekly checking shall be done as per CIAAN norms.
- Each student shall write any small program based on that experiment with algorithm and flowchart.
- While assessing ask some conceptual questions/ mock orals.
- Check the representation of students in manual.

5.4.3 Preparation for conduct of practical

- Form a batch of minimum number of students.
- Ensure that every student have manual with them while coming for practical. Ensure that at least one machine is available within a group of two students.
- Notes of related experiment shall be available with students.

6. Mode of assessment:

6.1 Class Test:

It is proposed that there will be two tests each of 25 Marks. The tests will be conducted as per the MSBTE Schedule

6.1.1 Guidelines for Setting Class Test Question Paper:

Following guidelines have to be followed for conducting Test Examinations at Institution Level.

1. Total of Test marks for all theory subjects are to be converted out of x (where x is as per teaching scheme) and to be entered in mark sheet under the head Sessional Work (SW). (Institutes should maintain Subject wise Record of Test Marks in Register.)

2. Each Test paper will have Three Questions:

i) Question 1 will be for NINE marks. This question will have each bit of three marks and students will have to attempt any THREE out of FOUR

ii) Question 2 & 3 will be for EIGHT marks each. These questions will have each bit of FOUR marks and student has to attempt any TWO out of THREE

Class Test:

It is proposed that there will be two tests each of 25 Marks. The tests will be conducted as per the MSBTE Schedule