CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

(Microprocessor & Programming -17431)

FOURTH SEMESTER
COMPUTER ENGINEERING GROUP

DECEMBER 2013

MAHARASHTRA STATE
BOARD OF TECHNICAL EDUCATION, Mumbai
(Autonomous) (ISO 9001:2008) (ISO/IEC 27001:2005)

INDEX

1. 0 APPROACH TO CURRICULUM DESIGN

1.1 BACKGROUND:

MSBTE is introducing the revised curriculum under 'G' scheme from the academic year 2012-13.

There are many institutions in the state running different diploma courses. In order to ensure uniform and effective implementation of the curriculum it is necessary that every teacher is aware of approach for curriculum design, educational principles to be adopted, learning resources to be used and evaluation methods. The teacher guide prepared for each subject will provide the inputs related to above mentioned aspects to achieve uniform and effective implementation of curriculum of various subjects.

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.

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

1.3 CURRICULUM:

"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.

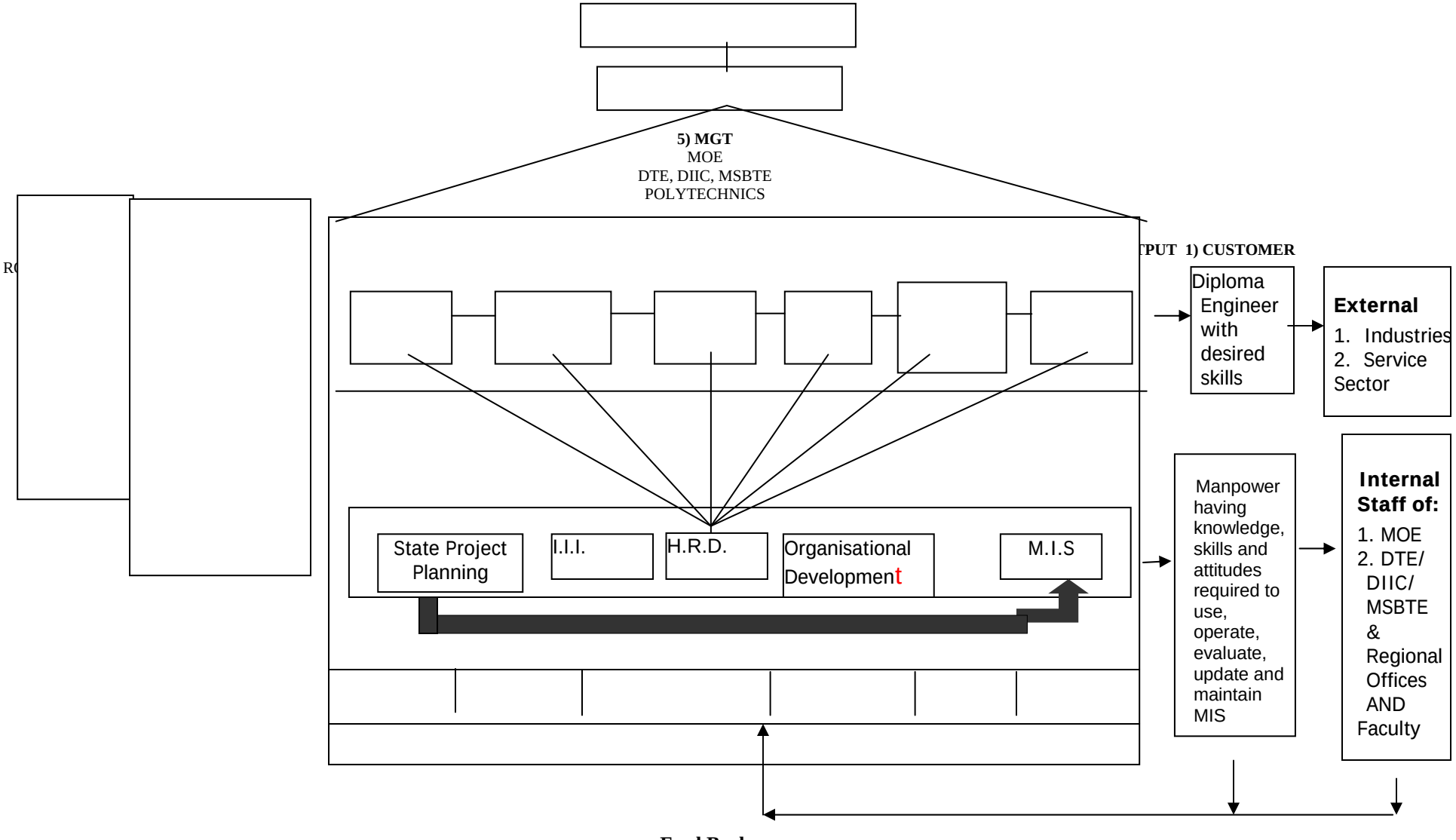


Fig 1 Systems Approach

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.

1.5 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 intellectual and motor skills in order to satisfactorily perform duties assigned to them:

A) Intellectual skills.

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 programs
8. Test and debug computer Program
9. Diagnose the hardware faults
10. Prepare and interpret software documentation

B) 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

1.6 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 Applied 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 Studies 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 at the sixth semester 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 Computer Engineering Group, for fourth Semester IF Computer Networks (CON) is replaced with Data Communication and Networking.
- For Fourth Semester IF, Applied Multimedia Technology Theory subject is changed to Practical.
- For Fifth semester CO, System Programming subject is included.

2. 0 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 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 whereas 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.

2.3 LEVELS OF LEARNING:

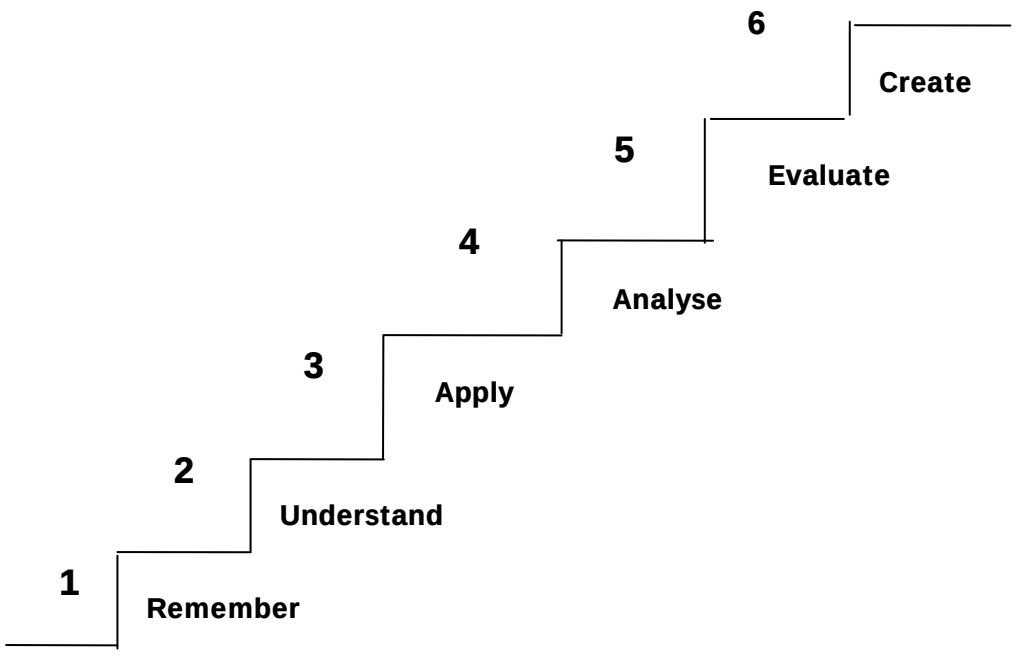
Question paper is a tool/ instrument designed to test the extent of learning of the student. Various questions set in a question paper should assess the abilities of students to respond to level of learning. Dr. Bloom a German educationist classified levels of learning in cognitive domain for the purpose 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 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 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 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.

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

2.5.2 Objectives: Objectives indicate what the student will be able to do/perform after he/she 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 Cognitive Domain knowledge is divided in four components as mentioned in the Two dimensional grid. Of this Factual, Conceptual and Procedural knowledge components are identified in the curriculum of the subject along with the 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.

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 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 as fulfill the objectives of the entire curriculum

3.0 CONTENT ANALYSIS

3.1 ComponentsofContentAnalysis:

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 teaching 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 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 (1 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. ConcreteConcepts: 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. AbstractConcepts: 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 CONCEPTATTRIBUTES:

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 **ofFriction**

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.

ForExample: (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.

Forexample:

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.

ForExample:

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.

ForExample:

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 makeimportant 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 amongst the teachers themselves. More importantly, Content Analysis will be a pre-requisite for writing Instructional Objectives of the topic to be taught. 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 : Fourth

Subject Title : Microprocessor and Programming

Subject Code : 17431

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	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:

Microprocessor is brain of computer. Intel family is widely used all over the world. 8085 is the 8-bit CPU and 8086 is the 16-bit CPU. 8086 is the base of all upward developed processors. It is more powerful and efficient computing machine. It overcomes all major limitations of the previous processors. It is able to get interfaced with 8-bit, 16-bit systems. IBM PC is introduced in 1980 with 10MB hard disk, one double side double density floppy disk drive, KBD, monitor and asynchronous communications adapter.

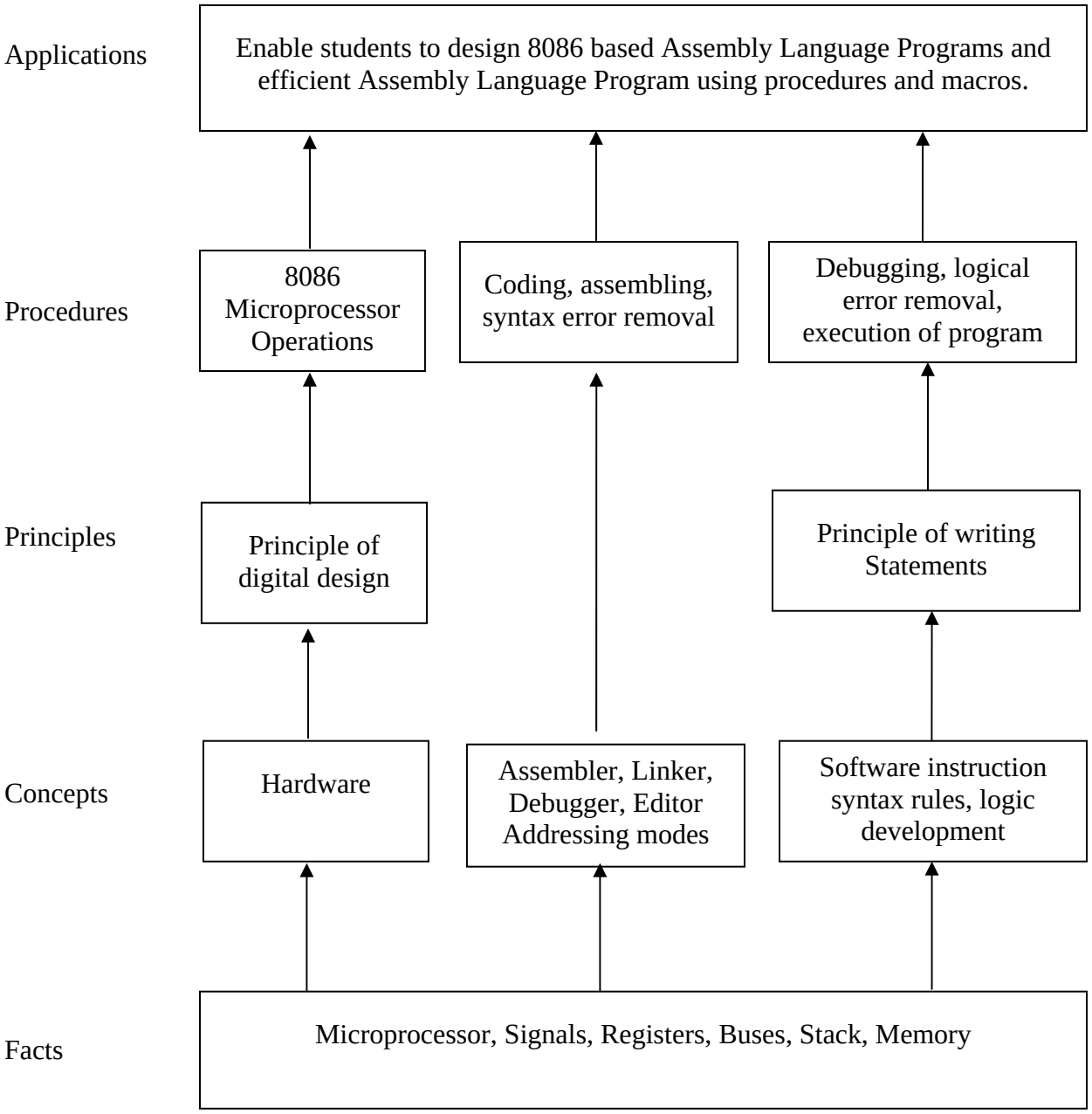
This subject covers Basics of 8085, architecture of 8086 along instruction set. It also covers assembly language programming with effective use of procedure and macros. This will act as base for the advanced assembly language programming for next generation microprocessors.

General objectives:

Students will be able to:

1. Understand the execution of instructions in pipelining and address generation.
2. Write syntax of given instructions.
3. Apply instructions in Assembly Language Program for different problem statements.
4. Use the procedures and macros in assembly language programming.

Learning Structure:



Theory

Name of Topics	Hours	Marks
Topic 1: Basics of Microprocessor Specific Objective: Students will be able to ➢ Draw the architecture of 8085 ➢ Define the functions of different pins of 8085 ➢ Identify status of different flags 1.1 Evolution of Microprocessor and types 1.2 8085 Microprocessor, • Salient features • Pin description, • Architecture of 8085 - Functional Block diagram, • Register organization,	04	08
Topic 2 :16 Bit Microprocessor: 8086 Specific Objective: Students will be able to ➢ Define the functions of different pins ➢ Draw functional block diagram of 8086 ➢ Understand the operating modes of 8086 2.1 8086 Microprocessor, • Salient features • Pin descriptions • Architecture of 8086 - Functional Block diagram • Register organization, • Concepts of pipelining, • Memory segmentation • Physical memory addresses generation. 2.2 Operating Modes of 8086 • 8284 Clock Generator • 8288 Bus Controller • 74LS245 Bi-directional Buffer • 74LS373 Octal Latch • Minimum Mode operation and its timing diagram • Maximum Mode operation and its timing diagram	12	24
Topic 3 : Instruction Set of 8086 Microprocessor Specific Objective: Students will be able to ➢ Understand the different types of instructions ➢ Identify the addressing modes of instructions ➢ State the operation of an instructions 3.1 Machine Language Instruction format, addressing modes 3.2 Instruction set, Groups of Instructions • Arithmetic Instructions • Logical Instructions • Data transfer instructions	10	20

• Bit manipulation instructions • String Operation Instructions, • Program control transfer or branching Instructions • Process control Instructions		
Topic 4 :The Art of Assembly Language Programming Specific Objective: Students will be able to ➢ Know the program development steps ➢ Use the different program development tools ➢ Illustrate the functions of assembler directive and operators 4.1 Program development steps • Defining problem, • Writing Algorithms • Flowchart • Initialization checklist • Choosing instructions • Converting algorithms to assembly language programs. 4.2 Assembly Language Programming Tools • Editors • Assembler • Linker • Debugger. 4.3 Assembler directives and Operators	04	08
Topic 5: 8086 Assembly Language Programming. Specific Objective: Students will be able to ➢ Write a appropriate programs using editor ➢ Run program using assembler and linker ➢ Debug program using debugger 5.1 Model of 8086 assembly language programs 5.2 Programming using assembler - • Arithmetic operations on Hex and BCD numbers - Addition, Subtraction, Multiplication and Division • Sum of Series • Smallest and Largest numbers from array • Sorting numbers in Ascending and Descending order • Finding ODD/EVEN numbers in the array • Finding Positive and Negative Numbers in array • Block transfer • String Operations - Length, Reverse, Compare, Concatenation, Copy • Count Numbers of ‘1’ and ‘0’ in 8/16 bit number • BCD to Hex and Hex to BCD number conversion	12	24
Topic 6 : Procedure and Macro in Assembly Language Program Specific Objective: Students will be able to ➢ Understand the purpose of procedure and macros ➢ Use procedure and macros 6.1 Procedure	06	16

• Defining Procedure - Directives used, FAR and NEAR • CALL and RET instructions. • Reentrant and Recursive procedures. • Assembly Language Programs using Procedure 6.2 Defining Macros. • Assembly Language Programs using Macros.		
Total	**48**	**100**

Skills to be developed:

Intellectual skills:

- Use of programming language constructs in program implementation.
- To be able to apply different logics to solve given problem.
- To be able to write program using different implementations for the same problem
- Study different types of errors as syntax semantic, fatal, linker & logical
- Debugging of programs
- Understanding different steps to develop program such as
  - Problem definition
  - Analysis
  - Design of logic
  - Coding
  - Testing
  - Maintenance (Modifications, error corrections, making changes etc.)

Motor skills:

- Proper handling of Computer System.

Practicals:

List of Practical:

1. Identify the Assembly Language programming tools like Assembler, linker, debugger, editor.
2. Write an Assembly Language Program to add / subtract two 16 bit numbers.
3. Write an ALP to find sum of series of numbers.
4. Write an ALP to multiply two 16 bit unsigned/ signed numbers.
5. Write an ALP to divide two unsigned/ signed numbers (32/16 , 16/8, 16/16, 8/8)
6. Write an ALP to add / Sub / multiply / Divide two BCD numbers.
7. Write an ALP to find smallest/ largest number from array of n numbers.
8. Write an ALP to arrange numbers in array in ascending/ descending order.
9. Write an ALP to perform block transfer data using string instructions / without using string instructions.

10. Write an ALP to compare two strings using string instructions / without using string instructions.
11. Write an ALP to display string in reverse order, string length, Concatenation of two strings.
12. Write an ALP to convert Hex to Decimal, Decimal to Hex.

Learning Resources

1. Books

Sr. No.	Name of Book	Author	Publication
1.	Microprocessor & interfacing (programming & hardware) Revised Second Edition	Douglas V. Hall	Tata McGraw Hill
2.	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S. Gaonkar	Penram International Publishing (India)
3.	The 8088 and 8086 Microprocessors	Walter A. Triebel, Avtar Singh	Pearson Publications
4.	The 8086.8088 Family, Design, Programming, and Interfacing	John Uffenback	PHI

2. Websites:

www.intel.com
www.pcguide.com/ref/CPU
www.CPU-World.com/Arch/
www.techsource .com / engineering- parts/microprocessor.html

5.0 IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

Teacher shall implement the methodology/ techniques mentioned in the following table while teaching the topics. Along with this teacher may use additional/alternative methods to make students learning more meaningful.

Topic 1 :**Basics of Microprocessor** **8M**

Knowledge Category	Example/s of category	Teaching methodology
FACT	Evolution of microprocessors, Basic features of 8 bit Microprocessor 8085, Address bus, Data bus, ALU, Registers	Show actual Microprocessor chip(kit) let the students handle the chip(kit), Give real time applications such as Temperature control systems, Video games, Programmable

		Robots, Traffic light control system.
CONCEPT	Clock, Multiplexing of Address/Data bus, Flag register	Use animated graphics to take inside view of Microprocessor
PRINCIPLE	Basics of Microprocessor with ALU, Control Unit and Register Unit, Principle of Multiplexing/ De-multiplexing,	Use examples and non-examples to explain.
PROCEDURE	Architecture of 8085(Block Diagram),and Functions of each pins.	Demonstrate through models/PPT
APPLICATION	----------	----------

Learning Resources:

Books:

Title: 1)Microprocessor Architecture, Programming and Applications with the 8085.

Author :Ramesh S. Gaonkar, Publication: Penram International Publishing (India)

Teaching Aids:

Video Lectures:

1. http://www.iitg.ernet.in/asahu/cs421
2. http://www.youtube.com/watch?v=I78iyzXQrP4

Websites :

1. http://www.youtube.com/watch?v=p4RcMLFIr5o
2. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

Lecture No.	Topic/ Subtopic to be covered
1	Evolution of Microprocessor and types
2	Salient Features of 8085 Microprocessor
3	Architecture of 8085 Microprocessor, Register Organisation
4	Pin diagram and functions of each pin of 8085 microprocessor

Topic 2 **:16 Bit Microprocessor: 8086** **24M**

Knowledge Category	Example/s of category	Teaching methodology
FACT	Basic features of 16 bit Microprocessor, Registers,	Show actual Microprocessor chip, let the students handle the chip and compare with 8085.
CONCEPT	Execution Unit, Bus Interface Unit, flag registers, Memory Segmentation, Concept of Pipelining.	Explain taking examples of queue also demonstrate faster processing speed using two units.
PRINCIPLE	8284 clock generator,8288 bus controller, 74LS245 bidirectional buffer,74LS373 Octal Latch,	Charts/slides.
PROCEDURE	Architecture with pin descriptions,	Charts, slides using PPT,

	Register organization, Maximum and minimum mode operations, timing diagrams	Compare Modes of operations.
APPLICATION	Memory address generation	Solving problems using various segment registers and offsets, Ask students to solve problems at home.

Learning Resources::

Books:

1. Microprocessor & interfacing (programming & hardware) , Revised Second Edition, Author: Douglas V. Hall , Publication: Tata McGraw Hill
2. The 8088 and 8086 Microprocessors , Author: Walter A. Triebel, Avtar Singh Publication: Pearson Publications
3. Title: The 8086.8088 Family, Design, Programming, and Interfacing Author: John Uffenbeck, Publication: PHI

Teaching Aids:

Websites:

1. http://elearning.vtu.ac.in/13/ENotes/8086
2. http://sirisha-engg-material.blogspot.in/2011/11/intel-8086-microprocessor-pins-and.html
3. http://en.wikipedia.org/wiki/Intel_8086
4. http://www.creativeworld9.com/2011/02/learn-microprocessors-and-interfacing.html
5. http://www.ee.ui.ac.id/~pupu/chapter_8/tsld008.htm
6. http://www.salkin.co.uk/~wiki/index.php/74LS245
7. http://www.cs.binghamton.edu/~reckert/480/480LECT2.html

Lecture No.	Topic/ Subtopic to be covered
1.	Introduction to 8086 Microprocessor, Salient features
2.	Comparison with 8085 microprocessor, Architecture of 8086 - Functional Block diagram
3.	Register organization, Pin descriptions
4 & 5	Concepts of pipelining, Memory segmentation, Physical memory addresses generation (atleast 4)
6.	8284 Clock Generator,8288 Bus Controller
7.	74LS245 Bi-directional Buffer, 74LS373 Octal Latch
8.	Minimum Mode operation with diagram
9.	Minimum Mode timing diagrams
10.	Maximum Mode operation with diagram
11.	Maximum Mode timing diagrams
12.	Comparison of operating modes and revision.

Topic 3**: Instruction Set of 8086 Microprocessor 20M**

Knowledge Category	Example/s of category	Teaching methodology
FACT	Instruction Definition, Instruction Format	Chart showing the instruction template
CONCEPT	Data accessing methods (Addressing Modes) using immediate value, register, memory location	Explain the various addressing modes using chalk-board/ PPTs
PRINCIPLE	Operation (working) of instruction	Demonstrate through appropriate PPT, Role play*
PROCEDURE	----------	----------
APPLICATION	To identify addressing modes in each instruction and use the instructions in programs.	Explain the usage of instructions in sample programs, Given the set of instructions, determine the output

References material:

1. Microprocessor 8086-Architecture, Programming and Interfacing by Sunil Mathur (Publication -PHI Learning Private Ltd.)
2. The 8086/8088 Family – Design, programming and Interfacing by John Uffenbeck (Publication -PHI Learning Private Ltd.)

Teaching Aids:

Charts, *Role Play by actual demonstration along with students.

Websites:

1. http://www.electronics.dit.ie/staff/tscarff/8086_instruction_set/8086_instruction_set.html
2. http://www.gabrielececchetti.it/Teaching/CalcolatoriElettronici/Docs/i8086_instruction_set.pdf
3. https://courses.engr.illinois.edu/ece390/books/artofasm/artofasm.html

Lecture No.	Topic / Subject to be covered
1	Instruction Format, Data addressing modes (8 modes)
2	Classification of instructions Data Transfer Instructions – MOV, IN, OUT, LDS, LES, LEA
3	Data Transfer Instructions – XCHG, PUSH, PUSHF, POP, POPF, LAHF, SAHF, XLAT
4	Arithmetic instructions – ADD, ADC, SUB, SBB, CMP, MUL, IMUL
5	Arithmetic instructions – DIV, IDIV, INC, DEC, NEG, CBW, CWD

6	Logical Instructions – AND, OR, XOR, NOT, TEST, Shift and Rotate Instructions
7	Branching Instructions – CALL (explain 4 addressing modes), RET, INT n, INTO, IRET
8	Branching Instructions – Unconditional and conditional Jump, Loop Bit Manipulation and Process Control Instructions
9	String Instructions – REP, MOVS, LODS, STOS, REPE, CMPS
10	String Instructions – REPNE, SCAS Arithmetic instructions – ASCII and Decimal adjustment

*** Role Play: Example XLAT instruction –**

For better understanding of XLAT instruction, role play, wherein students are enacting as registers and pointer can be used as follows.

Creating LOOK UP table: For converting the digits 0 – 9 to corresponding ASCII codes 30 – 39.

- Allocate the memory address to 10 benches (rows) in the class.
- Data bytes 30H to 39H are assigned to each bench.

Initialising :

- Three students will volunteer for BX register AL register and a pointer.
- BX student will take the first memory address (first row)
- AL student will assume a data byte in the range 0-9.

Execution:

- While executing XLAT,
    1. The Pointer adds AL with BX.
    2. Moves to the respective memory location (bench).
    3. The data from the bench is accessed and copied (told) into AL register

Conclusion : Using XLAT instruction, the AL register contents are translated to its code as per the look up table.

Note: The above role play can be used to demonstrate the working of other instructions such as MOVS, XCHG, PUSH etc.

Topic 4**: The Art of Assembly Language Programming** **8M**

Knowledge Category	**Example/s of category**	**Teaching methodology**
FACT	Algorithm, Flowcharts	Writing step by step procedure and draw flowchart by taking an example.
CONCEPT	Converting the algorithm/ flowchart into Assembly language program Assembler Directives, Assembly Language Programming Tools – Editors, Assembler, Linker, Debugger	Explain the conversion using example Explain the directives with syntax Explain the use and working of tools
PRINCIPLE	----------	----------
PROCEDURE	----------	----------
APPLICATION	----------	----------

Reference Material:

1. Microprocessor 8086-Architecture, Programming and Interfacing by Sunil Mathur

(Publication -PHI Learning Private Ltd.)
2. Microprocessors and Interfacing – Programming and Hardware by Douglas V. Hall (Tata McGraw Hill Revised Second Edition)

Websites:

1. http://elearning.vtu.ac.in/13/ENotes/8086/unit%203.pdf
2. http://prism2.mem.drexel.edu/~rares/asm4.htm

Lecture No.	Topic / Subject to be covered
1	Program development steps
2	Assembly Language Programming Tools – Editors, Assembler, Linker, Debugger
3	Assembler Directives
4	Revision

Topic 5: **8086 Assembly Language Programming** **24M**

Knowledge Category	Example/s of category	Teaching methodology
FACT	----------	----------
CONCEPT	Logic for solving the listed problem statements	Explain by taking example of addition of two numbers(8/16 bits)
PRINCIPLE	----------	----------
PROCEDURE	Implement the logic using 8086 instructions and directives	Write the program for addition of two numbers and let the students develop the program for subtraction. Assignments can be given for 32 bit operations.
APPLICATION	----------	----------

Reference Material:

1. Microprocessor 8086-Architecture, Programming and Interfacing by Sunil Mathur (Publication -PHI Learning Private Ltd.)

Websites:

http://elearning.vtu.ac.in/13/ENotes/8086/unit%203.pdf

Lecture No.	Topic / Subject to be covered
1	Model of 8086 assembly language programs
2, 3	Assembly Language Program for arithmetic operations on Hex and BCD numbers - Addition, Subtraction, Multiplication and Division
4	Assembly Language Program for sum of series, block transfer
5	Assembly Language Program for finding Smallest and Largest numbers from array
6	Assembly Language Program for sorting numbers in Ascending and Descending order
7	Assembly Language Program for finding ODD/EVEN numbers in the array

8	Assembly Language Program for finding Positive and Negative numbers in array
9	Assembly Language Program for String Operations (Length, Reverse, Compare, Concatenation, Copy)
10	Assembly Language Program for counting numbers of '1' and '0' in 8/16 bit number
11	Assembly Language Program for BCD to HEX conversion
12	Assembly Language Program for HEX to BCD conversion

Topic 6: **Procedure and Macro in Assembly Language Program** **16M**

Knowledge Category	**Example/s of category**	**Teaching methodology**
FACT	Definition of Procedure and Macro	Define and explain in classroom
CONCEPT	Syntax and the assembler directives used for Procedure and Macro	Describe the structure of Procedure and Macro and compare
PRINCIPLE	Recursion, Re-entrant Procedures, near & far procedures.	Give example
PROCEDURE	----------	----------
APPLICATION	Writing the assembly language programs using Procedures and Macros	Execute the programs in laboratory

Reference Material:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V. Hall (Tata McGraw Hill Edition)
2. The 8086/8088 Family – Design, programming and Interfacing by John Uffenbeck (Publication -PHI Learning Private Ltd.)
3. Microcomputer Systems: The 8086/8088 Family- Architecture, Programming, and Design (Second Edition) by Yu-cheng Liu & Glenn A. Gibson (Publication -PHI Learning Private Ltd.)

Websites:

http://oopweb.com/Assembly/Documents/ArtOfAssembly/Volume/Chapter_11/CH11-1.html

Lecture No.	**Topic / Subject to be covered**
1	Defining Procedure - Directives used, FAR and NEAR, CALL and RET instructions
2	Program using procedure- E.g: Factorial, Addition of 2 numbers
3	Reentrant and Recursive procedures. Assembly Language Programs using recursion.
4	Defining Macros – syntax
5	Assembly Language Programs using Macros
6	Compare between Far and Near Procedure, Procedure and Macros

5.2 PLANNING AND CONDUCT OF TEST:

a) The time table and sample test paper for the test should be displayed minimum 10 days before the test.
b) Each test will be of 25 marks.
c) First test should cover about 40% of curriculum and second test should cover remaining curriculum.

Sr. No	Class Test	Marks	Topics
1	Class Test 1	25	Topic 1, Topic 2, Topic 3.1, Topic 3.2 (data transfer instructions, arithmetic instructions)
2	Class Test 2	25	Topic 3.2 remaining topics to end of the chapter. Topic 4, Topic 5, Topic 6

5.1 **Details about conduct of assignments:**

- ✓ After completion of each chapter one assignment should be given.
- ✓ Assignment question shall be given from sample question paper, old MSBTE question papers
- ✓ It shall be assessed by subject teacher before giving next Assignment.
- ✓ Evaluation of Assignment should be done effectively.
- ✓ Sample question paper of Microprocessor and Programming to be solved by every student

5.4 STRATEGIES FOR CONDUCT OF PRACTICAL:

5.4.1 Suggestions for effective conduct of practical and assessment:

- Display the Date wise schedule of the experiment to be performed in the Laboratory.
- At the beginning of the semester teacher/lab assistant should check and ensure that the Computers and Assembler software used for the experiments are installed.
- Before start of any practical Teachers should explain the specific objective of that particular practical.
- Teacher should divide total students into number of group as given in practical manual.
- Teacher should refer the guidelines given in the lab manual.
- Teacher should make the students aware of instructions given in the lab manual.
- Teacher should ensure that the activities given in the Lab Manual are performed by thestudent and observations should be tabulated.
- Teacher shall assess the performance of students continuously as per norms prescribed by MSBTE CIAAN norms.
- During assessment teacher is expected to ask questions to the students to tap their achievements regarding related knowledge and skills so that students can prepare while submitting record of the practical. Focus should be given on development of enlisted skills rather than theoretical / codified knowledge.

5.4.3 Preparation for conduct of practical

Sr. No.	Activity	Duration
1.	Teacher shall explain the objectives of the experiment.	10 Min.
2.	Teacher shall demonstrate the execution and the desired output.	10 Min
3.	Teacher shall make the students perform the execution of programs and check the output by changing the input.	30 Min.
4.	Record the observations in the manual and write the appropriate outputs.	30 Min.
4.	Teacher shall evaluate the students' performance as per the CPA table.	40 Min.

6.0 MODE OF ASSESSMENT:

6.1 Class Test:

- 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.
- After completion of test, subject teacher should display model answer on Department Notice Board.
- Teacher should show the answer paper of class test to the student and discuss about the mistakes.
- Teacher should maintain the record of class test as per MSBTE norms (CIAAN)
- Format for question paper should be as per the sample question paper supplied by MSBTE.
- Guidelines for Setting Class Test Question Paper:
    - ❖ Question no.1 Attempt any three out of four (3X3=9 Marks)
    - ❖ Question no.2 Attempt any two out of three (2X4=8 Marks)
    - ❖ Question no.3 Attempt any two out of three (2X4=8 Marks)

6.1.1 Sample Test Papers:

Sample Test Paper

Sample Test Paper (Test 1) **17431**

Roll No.				

Institute Name:

Course Name: **Computer Engineering Group** Course Code: **CO/CD/CM/CW/IF**

Semester: **Fourth**

Subject**: Microprocessor and programming**

Marks: **25** Time: **1 hour**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Q1. Attempt any THREE of the following: 9

a) Explain the function of following pins of 8085 processor
   i. ALE
   ii. HOLD
   iii. HLDA
b) List any 6 features of 8086 microprocessor.
c) Given SS: 3450H; SP: 2A56H, calculate the physical address.
d) List any 2 addressing modes with example. Identify the addressing mode of the instruction MOV AL, [SI].

Q2. Attempt any TWO of the following 8

a) Draw the internal architecture of 8086.
b) Explain memory segmentation in 8086.
c) Differentiate between minimum mode and maximum mode.

Q3. Attempt any TWO of the following 8

a) Draw the flag register of 8086. Explain any 2 control flags.
b) Draw the timing diagram for maximum mode memory read cycle.
c) Explain the instructions of 8086
   i. XLAT
   ii. TEST

6.1.2 **Sample Test Paper (Test 2)**

Roll No.				

17431

Institute Name:

Course Name: **Computer Engineering Group** Course Code: **CO/CD/CM/CW/IF**

Semester: **Fourth**

Subject**: Microprocessor and programming**

Marks: **25** Time: **1 hour**

Instructions:

6. All questions are compulsory
7. Illustrate your answers with neat sketches wherever necessary
8. Figures to the right indicate full marks
9. Assume suitable data if necessary
10. Preferably, write the answers in sequential order

Q1. Attempt any THREE of the following: 9

a) Explain the following instructions
   i. ROL
   ii. MOVS
   iii. STD
b) Explain the assembler directives ASSUME, DW, EVEN.
c) Write the code segment for adding two 16 bit numbers.
d) Differentiate between FAR and NEAR calls (Any 3 points)

Q2. Attempt any TWO of the following 8

d) Explain Assembler and Linker.
e) Explain Recursive procedure with example.
f) Write an assembly language program to find the largest of 10 bytes.

Q3. Attempt any TWO of the following 8

d) Define Macro. Give an example and explain.
e) Write an assembly language program to transfer block of data from one location to another.
f) Write an assembly language program to convert HEX number to BCD.

Sample Question Paper:

Scheme G
Sample Question Paper

Exam Seat No.									

17431

Maharashtra State Board of Technical Education

Course Name: Computer Engineering Group **Course Code: CO/CD/CM/CW/IF**

Semester: Fourth

Title of the Subject: Microprocessor and programming

Marks: 100 **Time: 3 Hours**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Q1. a) Attempt any SIX of the following: **12**

(i) State the functions of the following pins of 8085 microprocessor
1) ALE 2) IO/$M^{\#}$

(ii) List all the 16 bit general purpose registers of 8086 microprocessor

(iii) List any two addressing modes of 8086 with one example each.

(iv) Draw the symbols used in a flowchart while developing ALP. Mention the use of each symbol (Any 4)

(v) State two uses of Accumulator in 8085.

(vi) State the use of OF and AC flags in 8086.

(vii) Give the syntax for defining the Macro.

(viii) Differentiate between SHR and ROR instructions of 8086. (2points)

Q1. b) Attempt any TWO of the following: **08**

(i) State the function of following assembly language programming tools.
a. Editor
b. Assembler
c. Linker
d. Debugger

(ii) Explain follwing assembler dirtecive
a. ASSUME

b. DB
c. DUP
d. ENDS

(iii) Differentiate between NEAR and FAR CALLs (4points)

Q2. Attempt any FOUR of the following: 16

a) Draw the flag register format of 8085 microprocessor and explain all the flags.
b) Draw the neat labeled architecture of 8086.
c) Explain how queuing speeds up the processing of 8086 operations.
d) List any 8 features of 8085 microprocessor.
e) What will be the contents of register BL after the last instruction execution?

```
MOV BL, 14H
MOV CL, 03H
SHL BL,CL
```

f) List the steps in physical address generation in 8086 microprocessor. Calculate the physical address for the given CS = 2340H , IP = 76A9H

Q3. Attempt any FOUR of the following: 16

a) Explain the following instructions with one example each.
1) ADD 2) AND 3) LEA 4) INC
b) State the functions for the following pins of 8086
1. NMI
2. $\overline{BHE}$
3. $\overline{TEST}$
4. $\overline{DEN}$

c) Draw the interfacing diagram of octal latch and explain it.
d) List and explain any 4 flag manipulation instruction of 8086 microprocessor.
e) Write assembly language program for reversing the string.
f) Differentiate between 8085 and 8086. (Any 4 points)

Q4. Attempt any FOUR of the following: 16

a) Identify the addressing modes for the following instructions:
1) MOV CL, 34H
2) MOV BX, [4172H]
3) MOV DS, AX
4) MOV AX, [SI + BX +04]
b) Explain the following instructions of 8086
1) DAA 2) XLAT
c) Write an Assembly Language program to count the number of 1's in BL register.
d) Write assembly language program to multiply two 8 bit numbers.
e) Write assembly language program to add two BCD numbers.
f) Define Procedure and explain the directives used in Procedure.

Q5. Attempt any FOUR of the following: 16

a) Write assembly language program to find the sum of 5 bytes of data.
b) How many times LOOP1 will be executed in the following program? What will be the contents of BL after the execution?

```
        MOV BL,00H
        MOV CL,05H
LOOP1:  ADD BL,02H
        DEC CL
        JNZ LOOP1
```

c) Write an Assembly Language program for BCD to Hex Conversion.

d) Write the appropriate 8086 instructions to perform the following operations:

1) Multiply AL register contents by 4 using shift instruction
2) Move 1234H into DS register.

e) Explain CALL and RET instructions.

f) Describe reentrant procedure with the help of schematic diagram.

Q6. Attempt any TWO of the following: 16

a) Draw the timing diagram of minimum mode memory write cycle. Also explain the same.

b) Write an Assembly Language program to transfer 10 bytes of data from one memory location to another. Also draw the flowchart for the same.

c) i) Define Macro. Give an example.

ii) Write a procedure to find the factorial of a number.