

CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

Automobile System & Body Engg (17409)

FOURTH SEMESTER AE-4G ENGINEERING GROUP

DECEMBER 2013



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

1. 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.

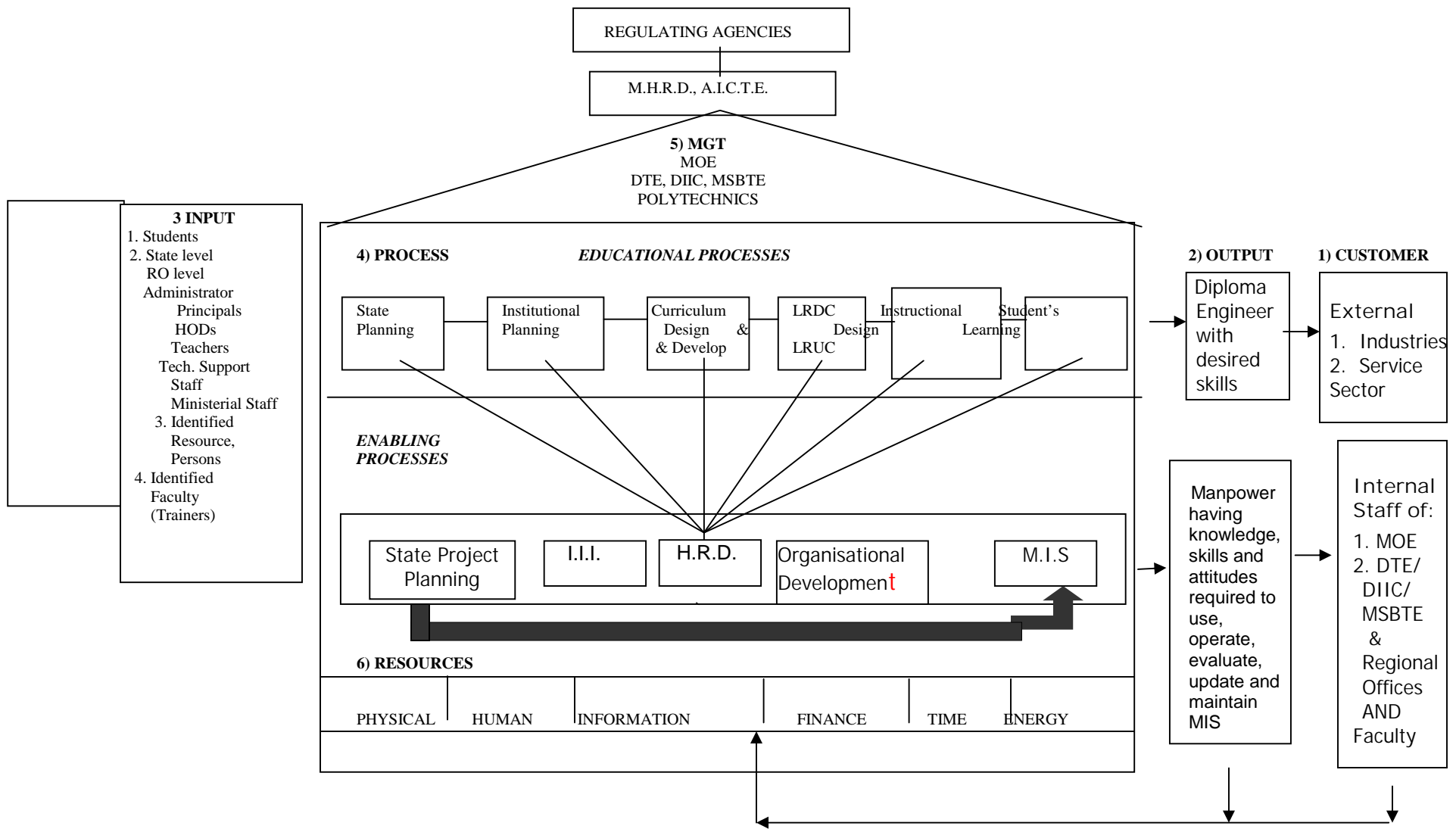


Fig 1 Systems Approach

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 Technological skills in order to satisfactorily perform duties assigned to them:

A) Intellectual Skills:

- 1) Read and interpret Automobile Engineering drawings.
- 2) Prepare spares and labor estimates for vehicle service.
- 3) Carryout loss assessment of accident vehicle.
- 4) Design simple automobile engineering components.
- 5) Prepare job card and warranty report.
- 6) Plan, execution of various vehicle service activities.
- 7) Test vehicle repair quality, prepare reports and interpret them.
- 8) Use various automobile engineering software.
- 9) Follow various standards and codes.
- 10) Maintain records in various formats.
- 11) Carry out vehicle scheduled and breakdown maintenance.
- 12) Maintain fleet of vehicle and keep transport related documents.
- 13) Supervise service and production work.
- 14) Select appropriate technique for quality control.

A) Motor Skills.

- 1) Prepare manual and Computer generated Automobile engineering drawings.
- 2) Use measuring instruments and prepare inspection reports.
- 3) Handle testing of equipments.
- 4) Lay out of different types of vehicle.
- 5) Draw free hand sketches of automobile components.

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 Modelling, 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.
- ❖ In Automobile Engineering, new subjects like 2-Wheeler Technology, Autotronics. Solid modelings, Cad (Auto) are introduced.

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 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.

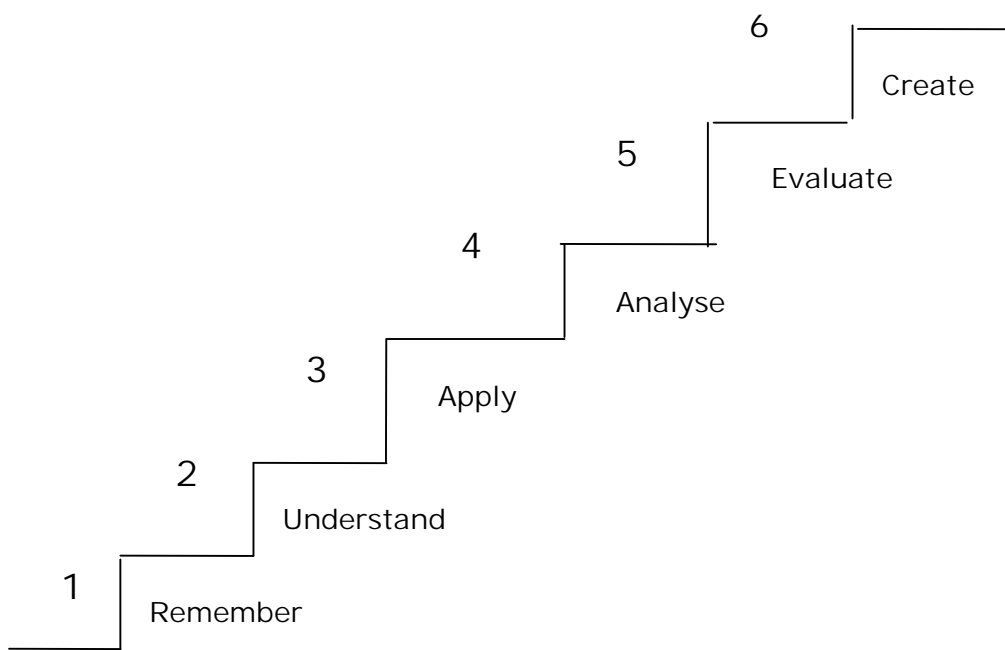
2.3 LEVELS OF LEARNING:

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 and 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	Understands fact, principles Interprets verbal material,	Convert, distinguish estimate, explain,

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.	Interprets charts, tables, graphs. Translates verbal material to mathematical formula. Estimates consequences implied in data. Justifies methods & procedures.	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 the entire curriculum.

Rationale tells the students the connection of subjects related to the 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/performance after he/she completes the study of the subject. It also in other words indicates the scope of the subject.

An objective indicates 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 provides 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 Practical. So in the curriculum the list of the skills to be developed through Practical 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. CONTENT ANALYSIS

3.1 Components of Content Analysis:

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

Before we begin actual 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 1 to 5 all of which belong to Cognitive Domain of Learning; Component 6 belongs to Psychomotor Domain and Component 7 belongs to Affective Domain (cannot be taught as these attitudes are caught), you will find that these differ from one another. The classification of human behaviors (activities) into the above three domains of learning entails the use of entirely different methods and media of instruction. Different locations of learning (classroom, laboratories, workshops, field visits) need to be selected.

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

3.1.1 FACTS:

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

3.1.2 CONCEPTS:

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

- 1. Concrete Concepts:** those which can be seen, touched and manipulated e.g. house, book, table, chair, cat, dog, any machine or apparatus, overhead projector, chalkboard and duster.

2. Abstract Concepts: those which cannot be seen and touched and handled but can only be imagined e.g. force, work, fractions, decimal, bending moment, moment of inertia, friction, heat, and induction. Teaching of concrete concepts is not that difficult because the teacher can show the object physically or its picture. On the contrary, teaching of an abstract concept offers difficulty to the teacher as well as for students to understand. These concepts can be learned by heart without understanding as children mug up Nursery Rhymes without understanding even a single word. But at the stage of higher learning, 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 other words, relationship between two or more concepts which is scientific and universally true is called a Principle.

For Example: (related concepts are underlined)

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

3.1.5 APPLICATIONS:

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

For example:

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

3.1.6 PROCEDURES:

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

For Example:

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

3.1.7 SKILLS (PSYCHOMOTOR):

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

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

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

For Example:

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

Laboratories and workshops of Polytechnics are the locations where these skills are developed among the students under the guidance of expert instructors *of* operators. Drill and practice are the main methods of teaching and learning these skills through model demonstrations and careful observations thereof.

Alongside developing these skills, desirable attitudes like cooperation, team work, leadership, safety, cost consciousness are also developed.

3.2 TEACHING OF CONCEPTS;

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

Steps Suggested:

1. Describe the performance expected of the student after he has learned the concept.
2. Reduce the number of attributes to be learned in complex concepts and make important attributes dominant.
3. Provide the student with verbal indicators (explanation).
4. Provide positive and negative examples (non-examples) of the concept.
5. Present the examples in close succession or simultaneously.
6. Provide occasions for student responses and the reinforcement of these responses, and
7. Assess the learning of the concept.

3.3 TEACHING OF PRINCIPLES:

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

Steps:

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

3.4 CONCLUSION:

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

4. CURRICULUM:

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Fourth

Subject Title : Automobile Systems and Body Engineering

Subject Code : 17409

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:

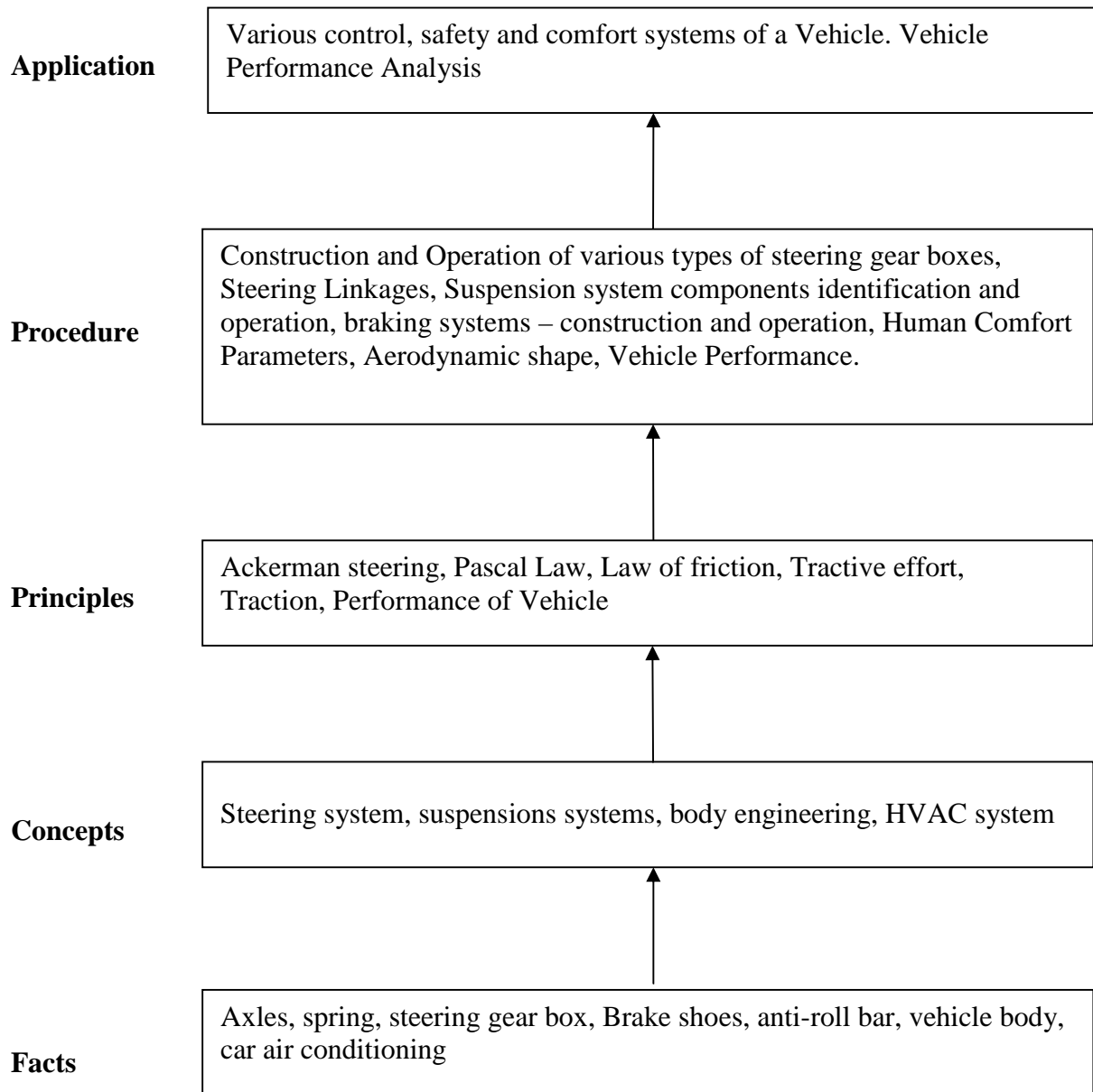
This subject is Core Technology subject for Automobile Engineering course. This subject is part of Automobile systems concerning control of vehicles. Knowledge of this subject is required in the subjects like Automobile Component Design, Vehicle maintenance, vehicle testing. Conceptual knowledge of this subject is useful for understanding and improving the performance of Automobile system.

General Objectives:

Students will be able to:

1. Understand construction, working and functions of Automobile Systems.
2. Understand construction, working and functions of Automobile control systems such as steering, braking and suspension.

Learning Structure:



Theory Content:

Topic and Contents	Hours	Marks
<p>1: Front Axle and Steering 22 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Know various types of steering linkages. ➤ Understand working of different steering gear boxes. ➤ Know steering geometry. ➤ Understand concept of power steering. <p>Content:</p> <p>1.1 Front Axle: 8 Marks</p> <ul style="list-style-type: none"> • Types of front axle - Dead axle, live axle. • Type of stub axle arrangements- Elliot, reverse Elliot, Lamoine, reverse Lamoine. • Front wheel assembly. <p>1.2 Steering system. : 14 Marks</p> <ul style="list-style-type: none"> • Steering linkages. • Steering geometry and its effects – Caster, camber, king pin inclination, toe in- toe out, Correct steering angle. Understeering and oversteering, Turning radius. • Construction, working and application of Steering gear box - rack and pinion type, recirculating ball type, and worm and roller type. • Ackerman Principle and linkage. • Power assisted steering and its types (Hydraulic and electrical) 	12	22
<p>2: Brakes 20 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Know various types of braking systems. ➤ Understand construction and working of different braking system components. ➤ Know latest developments in braking system. <p>Content:</p> <p>2.1 Introduction 8 Marks</p> <ul style="list-style-type: none"> • Function and necessity of brakes. • Classification of brakes and braking systems. • Construction and working of -disc brake and drum brake • Friction materials used for brake shoes and pads. Characteristics of friction material- brake fade, coefficient of friction, dry friction and wet friction <p>2.2 Braking systems 12 Marks</p> <ul style="list-style-type: none"> • Construction and working of - Mechanical braking system, Hydraulic Braking system, Air braking system, Hydraulic operated air braking system and vacuum assisted braking system. • Concept and working of antilock braking system. 	10	20

<ul style="list-style-type: none"> • Parking brake • Properties of brake fluids and their specifications. 		
<p>3: Suspension Systems 18 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify and describe various components of suspension systems. ➤ Know latest developments in suspension systems. <p>Content:</p> <p>3.1 suspension systems 10 Marks</p> <ul style="list-style-type: none"> • Rigid and independent Suspension. • Types of Independent suspension system-McPherson strut, wishbone type. • Semi-elliptical Leaf spring, coil spring , torsion bar arrangement, • Construction and working of Air Suspension System. <p>3.2 Construction and working of- 8 Marks</p> <ul style="list-style-type: none"> • Shock absorbers -Telescopic and Gas filled • Anti roll bar or stabilizer bar. 	10	18
<p>4: Body Engineering and Safety Devices. 16 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Know various types of materials used for automobile body. ➤ Understand protective treatment of automobile body. ➤ Know latest developments in safety devices. <p>Content:</p> <ul style="list-style-type: none"> • Types of bodies and materials used in body construction • Protective and anticorrosive treatments, painting and repainting procedure. • Safety devices –air bags, exhaust brake, emergency brake, central locking, Collapsible steering. 	06	16
<p>5: Car Heating Ventilation and Air Conditioning System (HVAC)</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand the basic principles of HVAC system. ➤ Know the comfort conditions of the occupants. <p>Content:</p> <ul style="list-style-type: none"> • Fundamentals of Refrigeration and air conditioning. • Description of vapour compression cycle with components in the circuit. • Layout and operation of HVAC. • Type of refrigerants used in car air conditioning and their properties. • Human comfort conditions. • Temperature control system, humidity control. 	06	16
<p>6: Vehicle Performance : 08 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Know and describe various resistances experienced by a vehicle. ➤ Understand the effects of resistances on a vehicle. <p>Content:</p> <ul style="list-style-type: none"> • Resistance faced by the vehicle- Air resistance , rolling resistance, 	04	08

gradient resistance <ul style="list-style-type: none"> • Definitions- traction, tractive efforts, drawbar pull, gradeability and acceleration, pitching, bouncing, rolling, sway and yaw. • Stability of vehicle on turn and slopes (No mathematical treatment). • Concept of Streamline shape of a vehicle body 		
Total	48	100

Practical:

Skills to be developed:

Intellectual Skills:

Student will be able to.

1. Identify parts like front axle, steering, brakes, suspension system.
2. Classify the system according to their application.
3. Select proper tools and their range.
4. Understand the construction and working of the system under consideration.

Motor Skills:

Student will be able to.

1. Sketch the different systems and their components.
2. Handle tools, equipment and instruments.
3. Dismantle and assemble various system assemblies.

List of Practicals:

01	Know your Automobile Systems laboratory through, listing the systems, models, and charts in laboratory with their purpose. <ul style="list-style-type: none"> • Listing the tools used in dismantling and assembly of various Automobile Systems.
02	Observe the steering linkages, draw its layout. Dismantle the steering gear box, identify its type, sketch its components and assemble it.
03	Observe and sketch different types of Front Axles.
04	<ul style="list-style-type: none"> • Observe and draw the layout of hydraulic braking system. Dismantle master cylinder, wheel cylinder and remove brake drum, identify and sketch the components and assemble it. Observe and draw the layout of hydraulically operated air/vacuum assisted braking system
05	<ul style="list-style-type: none"> • Observe and sketch the construction of Mc pherson and wishbone type suspension with labels. • Dismantle semi elliptical leaf spring, sketch its components with labels and understand its working. • Dismantle telescopic shock absorber, identify components and draw sketches of components with labels and understand its working.
06	Visit to automobile service station of heavy vehicle to observe air suspension system,

	air brakes, power steering system and draw layout. Write a report
07	Visit to Automobile Body Building and Body Manufacturing Industry, Prepare a report considering following points - Layouts, Body Construction, Body Materials, Body Repairs and Painting Procedure.
08	Observe and draw the layout of HVAC system. Measure the ambient temperature and temperature at various locations inside the car. Describe the control systems.

Notes:

1. A number of practicals may be started simultaneously.
2. The practicals may be performed in a group of 6 to 8 students.

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher / Edition
1	Ramlingam K.K.	Automobile Engineering	Scitech Publication
2	Kirpal Singh V-I	Automobile Engineering	Standard Publication
3	Anil Chikara V-II	Automobile Engineering	Satya Prakashan New Delhi
4	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
5	S. Srinivisan	Automotive Mechanics	Tata McGraw - Hill
6	Crouse / Anglin.	Automobile Mechanics	Tata McGraw - Hill

2. IS, BIS and International Codes:

3. Websites : www.npkauto.com

5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

Topic 1	Name: Front Axle and Steering		
	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.		
	Knowledge Category	Example/s of category	Teaching methodology
	FACT	Axles & steering gear boxes.	Explanation with chalk & board initially. Brings model parts in classroom or show in laboratory or use ppt /video for better understanding of facts.
	CONCEPT	Directional stability & effective control of vehicle.	Explanation with chalk & board initially. Show effect of steering by use of working model. Or make use of video/animation to get better understanding of concepts.
	PRINCIPLE	Ackerman's steering principle	Explanation with chalk & board initially. Demonstrate through appropriate ppt or video to learn the principle intended.
PROCEDURE	Front & rear axle Construction & steering geometry.	Explanation with chalk & board initially. Demonstrate through models/PPT/Actual steering & front axles available in the laboratory.	
APPLICATION	Vehicle steering performance for two & four wheeler.	Explanation with chalk & board initially step by step the procedure of steering & front axle	

			assembly. Show video.									
	<p>Learning Resources:</p> <p>Books:</p> <p>Title: 1)Automobile Engineering by R.B. Gupta 2) Automobile Engineering by .G.B.S. Narang</p> <p>Teaching Aids: Different front axles of four wheelers & steering gear boxes .</p> <p>PPTs: www.slideshare.com</p> <p>Websites:- ,fordindia.com</p>											
Lecture No.	Topic/ Subtopic to be covered											
1	Types of front axle-dead axle & live axle. Describe in detail stub axle arrangements viz Elliot, reverse Elliot.											
2	Describe in detail stub axle arrangements viz lamoine &reverse lamoine & front wheel assembly.											
3	Define the terms-camber, caster,king pin inclination & steering linkages with the help of neat sketches											
4	Define the terms toe-in, toe-out& correct steering angle with neat sketches.											
5	State the meaning of under-steering & over-steering.											
6	Describe turning circle radius& its effect.											
7	Explain the working of Rack & Pinion type steering gear box.											
8	Explain the working of Recirculating ball nut type steering gear box.											
9	Explain the working of worm & roller type steering gear box with neat sketch.											
10	Eexplain Ackerman's steering mechanism.											
11	With a neat sketch explain hydraulic power steering mechanism.											
12	Explain electric assisted steering mechanism.											
Topic 2	<p>Name: Brakes</p> <p>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 meaningful.</p> <table border="1"> <thead> <tr> <th>Knowledge Category</th> <th>Example/s of category</th> <th>Teaching methodology</th> </tr> </thead> <tbody> <tr> <td>FACT</td> <td>Brake drum, brake shoes, master,& wheel cylinder</td> <td>Explanation with chalk & board initially. Brings actual parts in classroom or show in laboratory or use ppt /video for better understanding of facts.</td> </tr> <tr> <td>CONCEPT</td> <td>Braking system</td> <td>Explanation with chalk & board initially. Make use of Charts & sketches</td> </tr> </tbody> </table>			Knowledge Category	Example/s of category	Teaching methodology	FACT	Brake drum, brake shoes, master,& wheel cylinder	Explanation with chalk & board initially. Brings actual parts in classroom or show in laboratory or use ppt /video for better understanding of facts.	CONCEPT	Braking system	Explanation with chalk & board initially. Make use of Charts & sketches
Knowledge Category	Example/s of category	Teaching methodology										
FACT	Brake drum, brake shoes, master,& wheel cylinder	Explanation with chalk & board initially. Brings actual parts in classroom or show in laboratory or use ppt /video for better understanding of facts.										
CONCEPT	Braking system	Explanation with chalk & board initially. Make use of Charts & sketches										

		for better understanding of students.
PRINCIPLE	Pascal's law	Explanation with chalk & board initially. Show models working on law and explain the principle behind it.
PROCEDURE	Construction & working of various types of braking system & operation	Explanation with chalk & board initially. Show workings model of hydraulic brake system its components like master & wheel cylinder brake shoes ,brake drum. Show also video for better understanding of contents
APPLICATION	Easy & effective control over vehicle.	Explanation with chalk & board initially. Make se of model ad also show actual vehicle brake performance like motor cycle & car.

Learning Resources::

Books: 1)Automobile Engineering by R.B. Gupta
2) Automobile Engineering by .G.B.S. Narang

Teaching Aids: Working models of mechanical &hydraulic brake system

PPT with Sample: www.slideshare.com

Websites: : <http://en.wikipedia> .com

Teaching Aids: Black board / White board, ppts, charts

Lecture No.	Topic/ Subtopic to be covered	
01	Function & necessity of brake, classification of brakes & braking system.	
02	Principle, construction& working of disc brake.	
03	Principle, construction& working of drum brake.	
04	Construction & working of mechanical brake system.	
05	Construction & working of hydraulic brake system	
06	Construction & working of air brake system	
07	Construction & working of air & vacuum assisted hydraulic brake system.	
08	Parking brake, friction material, co-efficient of friction, brake fade, dry & wet friction.	
09	Concept & working of Anti lock braking system	
10	Properties of brake fluids & their specification.	
Topic 3	Name: Suspension systems	
	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.	
	Knowledge Category	Example/s of Teaching methodology
	FACT	Suspension system Explanation with chalk & board initially. Show models /ppt /charts or video to get better understanding of suspension system.
CONCEPT	Reduce shocks & vibration of vehicle. Explanation with chalk & board initially. Show models /ppt /charts or video to get better understanding of concepts.	
PRINCIPLE	Dampening effect & vibration Explanation with chalk & board initially. Show models /ppt /charts or video to get better understanding	

			of these principles.
	PROCEDURE	Identify, Understand construction of various suspension system	Explanation with chalk & board initially. Discuss step by step procedure to understand these contents. Show charts, model or videos of working of suspension systems.
	APPLICATION	Locate & analyze function of suspension system.	Explanation with chalk & board initially Show actual working parts used in various vehicles/ industrial applications
<p>Learning Resources:: Books: 1) Automobile Engineering by R.B. Gupta 2) Automobile Engineering by .G.B.S. Narang 3) Automotive mechanics by Anglin \Crouse</p> <p>Teaching Aids: Telescopic shock absorber, coil spring, leaf spring. PPT with Sample: www.slideshare.com Websites: : http://www.fordindia.com</p>			
Lecture No.	Topic/ Subtopic to be covered		
1	Rigid & independent suspension		
2	Types of independent suspension system-Mcpherson strut .		
3	Types of independent suspension system- wish bone type		
4	Semi elliptical leaf spring & coil spring .		
05	Torsion bar arrangement.		
06	Construction of air suspension system.		
07	Working of air suspension system		
08	Construction & working of telescopic shock absorber.		
09	Construction & working of gas filled shock absorber.		
10	Antiroll bar or stabilizer bar.		

Topic 4	Name: Body Engineering & Safety Devices		
	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 meaningful.		
	Knowledge Category	Example/s of category	Teaching methodology
	FACT	Vehicle Body	Explanation with chalk & board initially. Explain by drawing the sketches of vehicle body. Show photographs, charts. Ppts. for better understanding.
	CONCEPT	Comfort & safety	Explanation with chalk & board initially. Show different models incorporating comfort and safety aspects. Discuss literature of specifications of 4-wheeler of top companies. Ask student to collect information seeking these aspect in modern vehicle
	PRINCIPLE	Efficient accommodation of goods & passengers.	Explanation with chalk & board initially. Show different models showing space for accommodation of goods and passengers in vehicle. Discuss literature of specifications of 4-wheeler of top companies. Ask student to collect information seeking these aspect in modern vehicle
PROCEDURE	Body Construction.	Explanation with chalk & board initially. Show different models and discuss body construction aspect. Discuss literature of specifications of 4-wheeler of top companies. Ask student to collect information about body construction aspect in modern vehicle	
APPLICATION	Different types of vehicle used for different purposes.	Explanation with chalk & board initially. Show different models and highlight their specific use for different purpose. Discuss literature of specifications of 4-wheeler of top companies. Ask student to collect information and list out the different applications and uses of different vehicles.	
Learning Resources: Books: Title: 1) Automobile Engineering by R.B. Gupta			

	<p>2) Automobile Engineering by .G.B.S. Narang 3) Automotive mechanics by Anglin \Crouse Teaching Aids: Various vehicle bodies like car jeep, truck, bus etc PPTs: www.slideshare.com Websites www.tatamotors.com</p>		
Lecture No.	Topic/ Subtopic to be covered		
1	Types of bodies & materials used in body construction.		
2	Protective & anticorrosive treatment for vehicle body.		
3	Painting procedure of new vehicle.		
4	Repainting procedure for old vehicle.		
5	Safety devices-Air bags, exhaust brakes, emergency brake.		
6	Central locking, collapsible steering.		
Topic 5	<p>Name: Car Heating Ventilation & Air Conditioning System (HVAC)</p> <p>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.</p>		
	Knowledge Category	Example/s of category	Teaching methodology
	FACT	Refrigeration & Air Conditioning	Explanation with chalk & board initially Show actual apparatus form laboratory, Use ppt.
	CONCEPT	Human Comfort	Explanation with chalk & board initially Discuss conditions human comforts in details.
	PRINCIPLE	Second law of thermodynamics	Explanation with chalk & board initially. Discuss laws with suitable examples.
	PROCEDURE	Vapor compression \ absorption cycle	Explanation with chalk & board initially Explain the refrigeration cycles and conduct trial on experimental setup during practical classes.
	APPLICATION	Car, air conditioning, humidity control & ventilation.	Explanation with chalk & board initially Show actual car a/conditioner in different cars. Ask students to collect information about car A/C in different car models of top companies.
	Learning Resources:		

	<p>Books:</p> <p>Title: 1) Automobile Engineering by R.B. Gupta 2) Automobile Engineering by .G.B.S. Narang</p> <p>3) Automotive mechanics by Anglin \Crouse</p> <p>Teaching Aids: Various Air conditioning system used in vehicle.</p> <p>PPTs: www.slideshare.com</p> <p>Websites www.tatamotors.com.,www.maruticars.com</p>																
Lecture No.	Topic/ Subtopic to be covered																
1	Fundamentals of refrigeration & air conditioning.																
2	Description of vapour compression cycle with components in the circuit.																
3	Layout & operation of HVAC																
4	Type of refrigerants used in car air conditioning & their properties.																
5	Human comfort conditions																
6	Temperature control system, humidity control.																
Topic 6	Name: Vehicle Performance <p>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 meaningful. e.g.</p> <table border="1"> <thead> <tr> <th>Knowledge Category</th> <th>Example/s of category</th> <th>Teaching methodology</th> </tr> </thead> <tbody> <tr> <td>FACT</td> <td>Vehicle performance</td> <td>Explanation with chalk & board initially Discuss the vehicle performance by using graphs. Ask students to collect information about performance of different cars of top companies,</td> </tr> <tr> <td>CONCEPT</td> <td>Various resistances</td> <td>Explanation with chalk & board initially Discuss types of resistances.</td> </tr> <tr> <td>PRINCIPLE</td> <td>Newton's law of motion.</td> <td>Explanation with chalk & board initially Discuss laws with suitable practical example in field,</td> </tr> <tr> <td>PROCEDURE</td> <td>Effect of various resistances on a vehicle.</td> <td>Explanation with chalk & board initially. Discus in details effect of resistance on vehicle. Shoe video/ ppt for better understanding.</td> </tr> </tbody> </table>		Knowledge Category	Example/s of category	Teaching methodology	FACT	Vehicle performance	Explanation with chalk & board initially Discuss the vehicle performance by using graphs. Ask students to collect information about performance of different cars of top companies,	CONCEPT	Various resistances	Explanation with chalk & board initially Discuss types of resistances.	PRINCIPLE	Newton's law of motion.	Explanation with chalk & board initially Discuss laws with suitable practical example in field,	PROCEDURE	Effect of various resistances on a vehicle.	Explanation with chalk & board initially. Discus in details effect of resistance on vehicle. Shoe video/ ppt for better understanding.
	Knowledge Category	Example/s of category	Teaching methodology														
	FACT	Vehicle performance	Explanation with chalk & board initially Discuss the vehicle performance by using graphs. Ask students to collect information about performance of different cars of top companies,														
	CONCEPT	Various resistances	Explanation with chalk & board initially Discuss types of resistances.														
	PRINCIPLE	Newton's law of motion.	Explanation with chalk & board initially Discuss laws with suitable practical example in field,														
PROCEDURE	Effect of various resistances on a vehicle.	Explanation with chalk & board initially. Discus in details effect of resistance on vehicle. Shoe video/ ppt for better understanding.															

	APPLICATION	Streamlining process	Explanation with chalk & board initially. Explain body construction by sketches, graphic tools and videos. Give assignments to the students about construction of different models
	<p>Learning Resources:</p> <p>Books:</p> <p>Title: 1) Automobile Engineering by R.B. Gupta 2) Automobile Engineering by .G.B.S. Narang 3) Automotive mechanics by Anglin \Crouse</p> <p>Teaching Aids: Various vehicle bodies like car jeep, truck, bus etc</p> <p>PPTs: www.slideshare.com</p> <p>Websites www.tatamotors.com</p>		
Lecture No.	Topic/ Subtopic to be covered		
1	Resistance faced by the vehicle –air resistance, rolling resistance, gradient resistance.		
2	Definitions of Traction, tractive efforts, draw bar pull, gradability & acceleration, pitching, bouncing, rolling, swaying & yawing.		
3	Stability of vehicle on turn & slopes.		
4	Concept of streamline shape of a vehicle body.		

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.
- d) Format for question paper should be as per the sample question paper supplied by MSBTE.
- e) **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)

5.3 Details about conduct of assignments:

5.4 Strategies for Conduct of Practical:

- **Student should be made familiar with all the equipments in the laboratory.**
- **The practicals shall be carried out exactly as mentioned in the syllabus as far as possible.**
- **Industrial visit shall be carried out as far as possible. If concerned industry /Hydroelectric power plant. video clips which are available on various website shall be shown to the students.**

5.4.1 Suggestions for effective conduct of practical and assessment:

- **Use of lab manuals develop by M.S.B.T.E. should be followed.**
- **Check the correctness of experimental reading.**
- **See that each student is involved in conduction of practicals as per the guide lines and instructions given by the teacher and M.S.B.T.E. developed manuals.**

5.4.3 Preparation for conduct of practical

6. Mode of assessment:

1.1 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)

6.1.2 Sample Test Papers:

Sample Test Paper I

Roll No.				
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17409

Institute Name:

Course Name: **Automobile Engineering**

Course Code: AE

Semester: 4 G

Subject: **Automobile System & Body Engineering (17409)**

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

(3*3=9)

- a) State the factors which affect steering.
- b) List types of steering gear boxes.
- c) State the main functions of brake.
- d) Mention the types of suspension springs.
- e) State the functions of a suspension system.

Q2. Attempt any Two

(4*2=8)

- a) Define the terms – 1) Camber 2) Castor 3) Toe-in & 4) King- Pin inclination.
- b) Explain Ackerman's steering gear principle.
- c) Explain with neat sketch working of a mechanical brake system.

Q3. Attempt any Two

(4*2=8)

- a) Explain with neat sketch working of a telescopic shock absorber.
- b) Draw a neat sketch of master cylinder.
- c) Explain torsion bar mechanism with a neat sketch.

Sample Test Paper II

Roll No.

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17409

Institute Name:

Course Name: **Automobile Engineering**

Course Code: AE

Semester: 4 G

Subject: **Automobile System & Body Engineering (17409)**

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 (3*3=9)

- a) Define streamlining process and state its effect.
- b) List Main Parts of automobile air conditioning system.
- c) State various resistances to which a vehicle is subjected.

Q2. Attempt any Two

(4*2=8)

- a) Explain denting process of a vehicle.
- b) Explain the terms 1) Bouncing & 2) Rolling.
- c) State and explain Human comfort conditions.

Q3. Attempt any Two

(4*2=8)

- a) Explain the process of anti-corrosive treatment.
- b) Explain layout and operation of HVAC.
- c) Explain traction and tractive effort.

6.2.1 Specification Table:

Course Name: Automobile Engineering

Course Code: AE

Semester: 4 G

Title of the Subject: Automobile System & Body Engg.

Subject Code: 17409

Level Chapter /Topic	Levels from Cognition Process Dimension			Total Marks
	R	U	A	
01	6(2)	8(4)	8(4)	22(10)
02	4(2)	8(8)	8	20(10)
03	2	12(4)	4(4)	18(8)
04	4(4)	8	4(4)	16(8)
05	4	12(8)	----	16(8)
06	8(4)	----	----	8(4)
Total	28(12)	48(24)	24(12)	148

R – Remember

U – Understand

A=Analyse/Apply

6. 2. 2 QUESTION PAPER PROFILE:

Course Name: Automobile Engg.

Course Code: AE

Semester: 4G

Title of the Subject: Automobile Systems & Body Engg.

Subject Code: 17409

Q. No.	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Bit 7			Bit 8			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01a	1.2	R	2	1.2	R	2	2.2	R	2	3.1	R	2	5	R	2	5	R	2	6	R	2	6	R	2	6(8)
01b	4	R	4	6	U	4	5	U	4																2(3)
02	1.1	R	4	1.2	A	4	1.2	U	4	2.1	R	4	3.2	A	4	2.1	U	4							4(6)
03	2.1	U	4	5	U	4	3.1	A	4	1.1	U	4	4	R	4	4	A	4							4(6)
04	1.2	A	8	2.2	U	8	3.2	U	8																2(3)
05	1.2	U	4	4	A	4	3.1	U	4	5	U	4	3.1	U	4	6	U	4							4(6)
06	2.2	A	8	5	U	8	4	U	8																2(3)

T = Topic/Chapter Number

L = Level of Question

M = Marks

R = Remember

U = Understand

A = Analyse/Apply

6.2.3 Sample Question Paper:

Sample Question Paper

Exam seat No.						
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17409

Maharashtra State Board of Technical Education

Institute Name:

Course Name: **Automobile Engineering**

Course Code: AE

Semester: 4 G

Subject: **Automobile Systems & Body Engineering (17409)**

Marks: **100**

Time: **03 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**

2x6=12

- a) Define turning radius.
- b) Name the components of steering system use in case of car. (Any four)
- c) List any four desired properties of brake fluid.
- d) State the function of Anti roll bar.
- e) Mention the name of refrigerant used in car air conditioner. (Any four)
- f) State the function of the evaporator in car HVAC system.
- g) Define traction.
- h) Define gradiability.

Q1 (B) Attempt any **Two.**

4x2=8

- a) State the function of collapsible steering and explain its working.
- b) Define the terms pitching, bouncing, swaying & yawing.
- c) Write the properties of ideal refrigerant. (Any eight)

Q2. Attempt any **Four.**

4x4=16

- a) State the type of stub axle and explain any two types of stub axle arrangements.
- b) Explain Ackerman's principle of steering and linkage with sketch.

- c) Draw a neat sketch of Worm and roller type steering gear box.
- d) Name the materials used for brake liner and define co-efficient of friction.
- e) Differentiate between telescopic shock absorber and gas filled shock absorber.
- f) Draw a neat labeled sketch of disc brake with fixed caliper.

Q3. Attempt any **Four**. **4x4=16**

- a) Classify the brakes and State the necessity of brakes.
- b) Draw the layout of HVAC system.
- c) Explain the working of suspension system used in case of auto-rickshaw.
- d) Explain with neat sketch, 'Front wheel Assembly'.
- e) State the need of painting and write procedure for new car painting.
- f) List the safety devices used in a modern car. Explain any one with figure.

Q4 Attempt any **Two** **8x2=16**

- a) Explain steering gear box for Maruti 800 vehicle with neat label sketch.
- b) With a neat sketch explain the working of hydraulic brake system.
- c) Describe working of telescopic type shock absorber.

Q5 Attempt any **four** **4x4=16**

- a) With neat sketch explain toe-in.
- b) Explain inflation of Air bag during a head of collision.
- c) Explain with neat sketch working of air suspension system.
- d) State and explain human comfort conditions used in car Air conditioner.
- e) Describe the Macpherson strut assembly of independent suspension system.
- f) List the resistance faced by vehicle and explains any one.

Q6 Attempt any **Two** **8x2=16**

- a) Explain concept and working of antilock braking system.
- b) Draw a layout of vapour compression system and explain its working.
- c) Explain the necessity of protective and anti corrosive treatment before painting. Write the major steps involved in it
