

CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

**VEHICLE LAYOUT AND TRANSMISSION
SYSTEM (17307)**

**THIRD SEMESTER MECHANICAL ENGINEERING
GROUP**

JUNE 2013



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

1. APPROACH TO CURRICULUM DESIGN

1.1 INTRODUCTION

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

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

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

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

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

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

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

1.2 CURRICULUM PHILOSOPHY

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

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

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

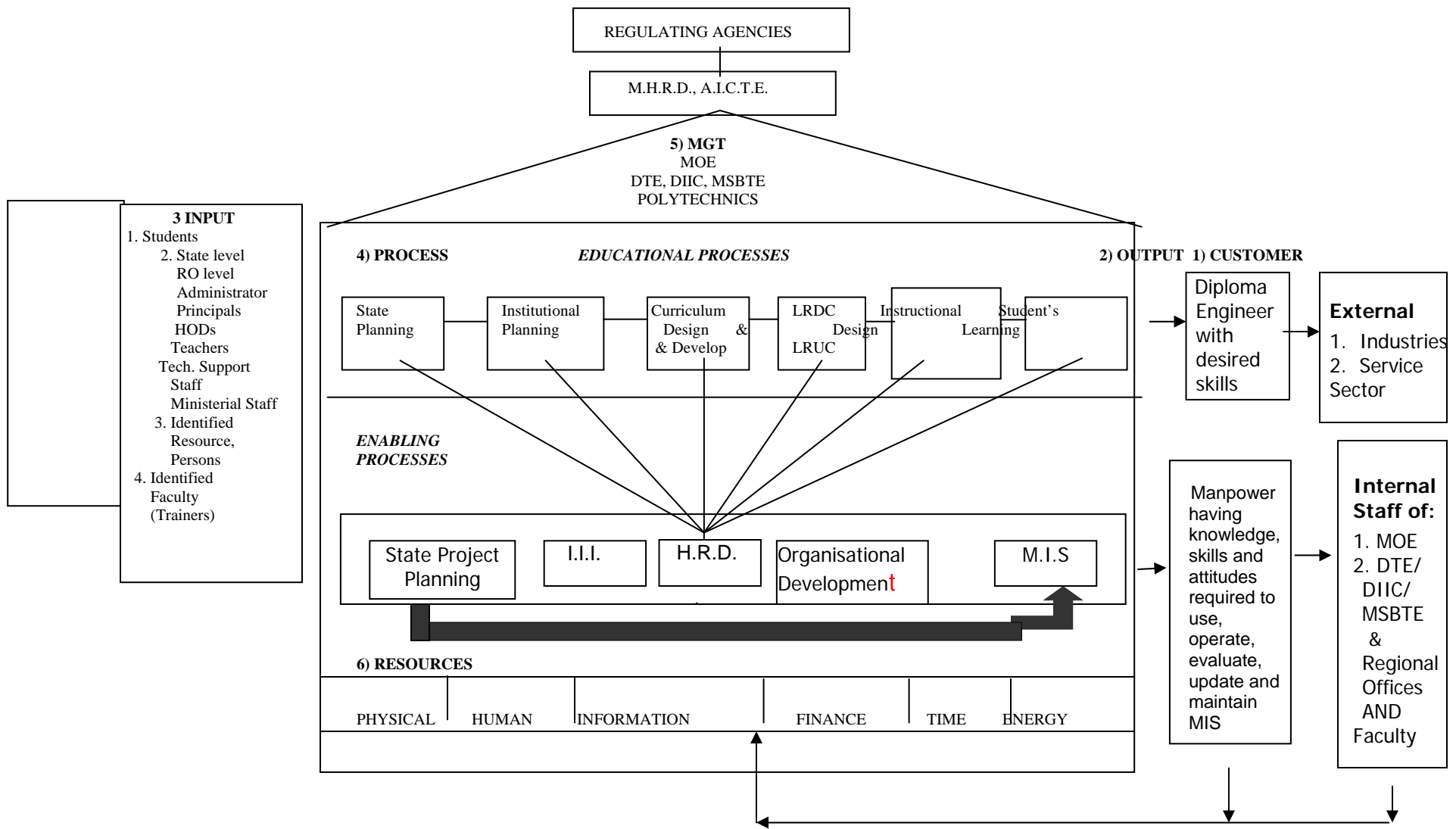


Fig 1 Systems Approach

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

“Curriculum is an educational program designed and implemented to achieve specified educational objectives”

This definition takes into account the fact that

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

1.3 Curriculum goals

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

DESIRED SKILLS

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

Life Skills:

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

- Develop computer proficiency
- Develop observation skills

Technological Skills:

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

A) Intellectual Skills:

- Reading and interpretation of production drawings
- Planning for materials, tools, processes and quality control techniques.
- Use of Operation and Maintenance Manuals
- Operation of new equipment, machinery and instruments like CNC, PLC, controllers, Robotics, EDM, ECM, laser cutting/welding, etc
- Use of CAD for 2D drawings and familiarity with CAD software like Idea, Catia, Pro-E etc (Awareness level)
- Use of Moderns manufacturing techniques used in industry like 5S, Six sigma, TQM, TPM, ZD, JIT, Kanban, Poka-Yoke, Quality Control Charts, Reliability engineering, etc.
- Design of Machine Element
- Problem solving skills
- Cost Reduction techniques
- Use of standards (ISO-9000, QS14000, etc)

B) Motor Skills:

- Maintenance of modern equipments and machineries
- Develop drafting Skills
- Operate Lathes, Drilling Machines, CNC Machines, Milling and Shaping Machines, Grinding Machines,
- Test Machine Performance
- Draw sketches of Civil engineering structures
- Carry out In process gauging
- Setting up of Automatic machines

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.

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 LEVELS OF LEARNING:

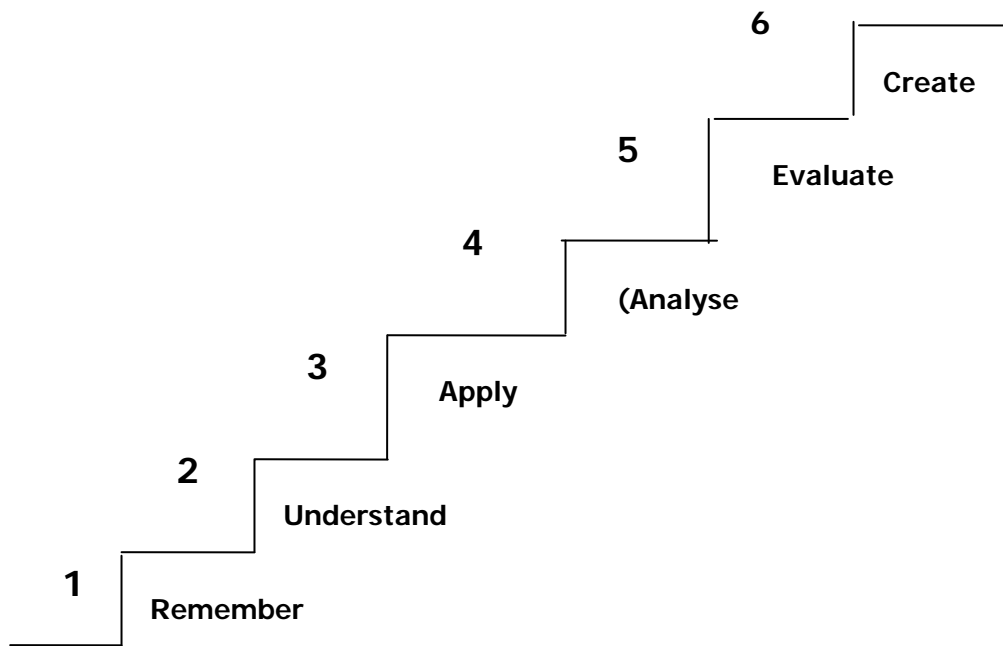
Question paper is a tool/ instrument designed to test the extent of learning of the student. Various questions set in a question paper should assess the abilities of students to respond to level of learning. Dr. Bloom a German educationist classified levels of learning in cognitive domain for the purpose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

2.2.1 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	Understands fact,	Convert,

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

Importance of the subject is on two counts:

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

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

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

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

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

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

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

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

2.5.4 Contents: List of topics and subtopics to be included in the curriculum of the subject is given in the contents. This helps in achieving the rationale and objectives identified. Contents indicate the importance of the topics, sub topics in development of the subject and accordingly weightages in terms of Hours required to teach the subject components, so that the desired learning takes place. Marks to be allotted while testing the knowledge gained by the student are also indicated.

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

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

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

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

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

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

3.1.1 FACTS:

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

3.1.2 CONCEPTS:

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

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

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

3.1.3 Concept Attributes:

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

Example: The Concept of Friction

Attributes:

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

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

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

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

3.1.4 PRINCIPLES:

A principle is a statement of relationship between two or more concepts. Principles are sometimes called rules, laws or generalizations. In 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 : Third

Subject Title : Vehicle Layout and Transmission System

Subject Code : 17307

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	50#	---	25@	175

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:

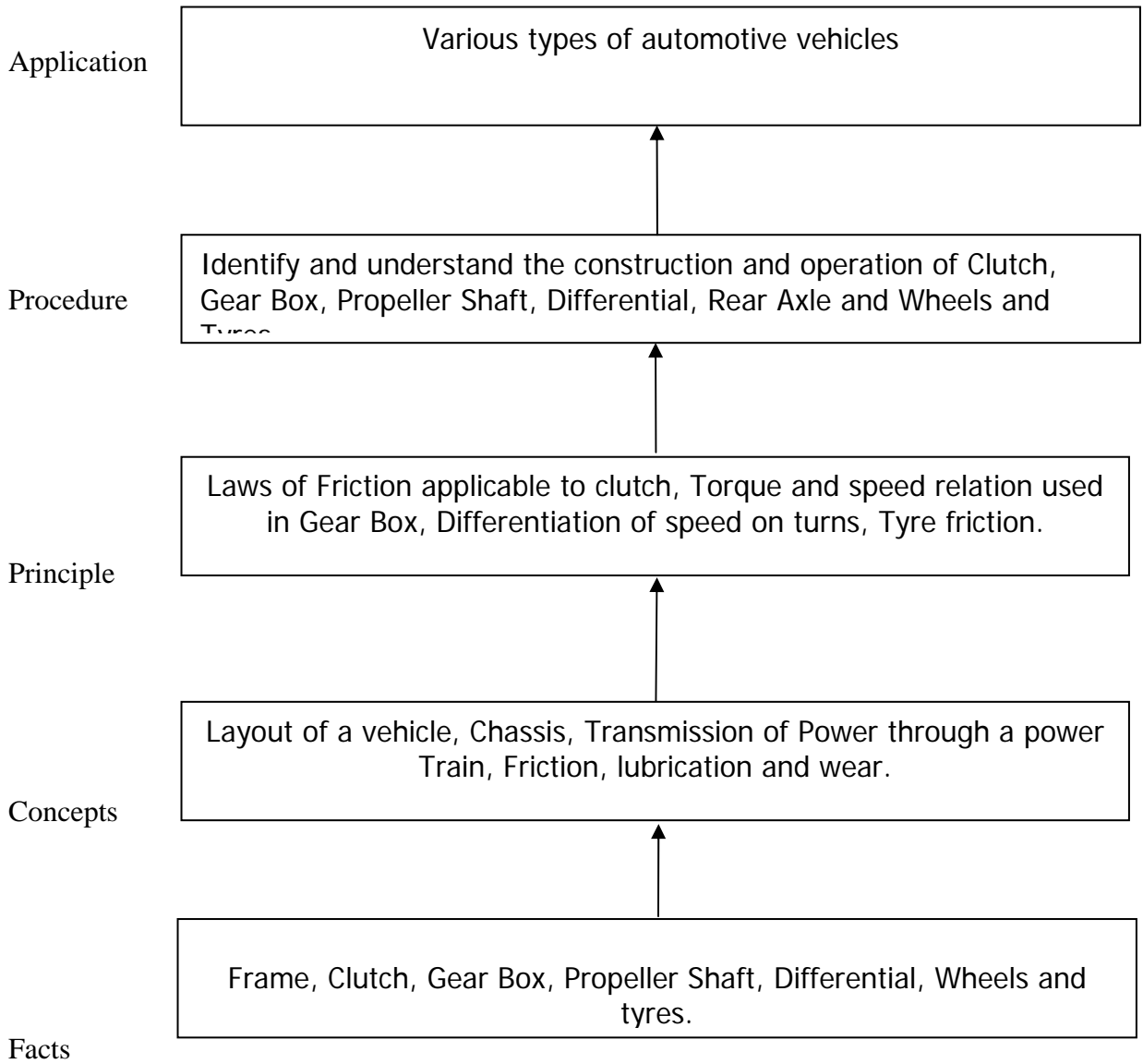
This subject is a core Automobile Engineering subject. The subjects give knowledge about the various components of the transmission train and vehicle layout. This subject forms the basis for the subjects Automobile Systems, Vehicle Maintenance and Vehicle Testing. Basic principles and conceptual knowledge of this subject is useful for understanding the power transmission phenomenon and improving the performance of vehicles.

General Objectives:

The Student will be able to -

1. Understand the vehicle layouts, chassis, frame and location of various systems on chassis.
2. Know the principle, construction and working of elements of transmission system.
3. Understand the terminology and construction of wheels and tyres.

Learning Structure:



Theory:

Topic and Content	Hours	Marks
<p>1. Vehicle layout and Chassis frame 12 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand the layout of an Automobile ➤ Identify various components and their Location on the Vehicle. ➤ Understand the frames used for two and four wheeler. ➤ List various loads acting on the frame. <p>Content:</p> <p>1.1 Vehicle layout and its types 4 Marks</p> <ul style="list-style-type: none"> • Definition of -an automobile, layout of a vehicle. • Layout of the front engine rear wheel driven vehicle and explain location and function of major vehicle components and systems in brief. (With Sketch) • Classification of vehicle layout with respect to i) Location of engine, ii) No of live axles, iii) Arrangement of Engine, Passenger and Luggage section, iv) Application <p>1.2 Chassis Frames 8 Marks</p> <ul style="list-style-type: none"> • Introduction – Necessity of frame and its functions. Loads acting on frame. Types of frames- conventional (ladder and x-member type), semi integral and integral types. Frame sections-channel, box and tubular sections. Materials for frames. Sub frames 	08	12
<p>2. Clutches 20 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify components of various types of clutches. ➤ Understand construction and working of various types of clutches. <p>Content:</p> <p>2.1 Clutch Introduction 4 Marks</p> <ul style="list-style-type: none"> • Necessity of clutch. • Classification - friction and Non friction type clutches <p>2.2 Construction and Operation of Different type of clutches 16 Marks</p> <ul style="list-style-type: none"> • Construction and Operation of a single plate (coil and Diaphragm) dry disc clutch, multi plate, wet clutch, centrifugal clutch, Variator Drive. • Construction details of Clutch plate. Clutch lining materials. • Clutch operating mechanisms-mechanical, hydraulic, vacuum. • Fluid Coupling – Principle, Construction and Working. 	10	20
<p>3. Automotive Gear boxes 20 Marks</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify components of various types of Gear Boxes. ➤ Understand construction and working of various types of Gear Boxes. ➤ Know the principle of operation of Gear Box. <p>Content:</p> <p>3.1 Gear Box 12 Marks</p>	10	20

<ul style="list-style-type: none"> • Types of Tyres -radial, cross ply, belted bias type • Specification of tyres • Concept of Aspect ratio • Types of tread patterns • Effect of inflation pressure on the life of tyre and tyre rotation. 		
Total	48	100

Practicals:

Skills to be developed:

Intellectual Skills:

1. Select hand tools and special tools.
2. Identify parts like clutch, gear box, universal joints, propeller shaft, final drive, wheels and tyres.
3. Understand the Construction and working of Clutch, Gear Box, Propeller Shaft, Differential and Wheels and Tyres.

Motor Skills:

1. Sketch the different components of transmission system.
2. Use of hand tools, equipments, instruments.
3. Dismantle and assemble various transmission systems.

List of Practical:

1. Understand the layout, of “Vehicle Layout and Automobile Transmission System laboratory” and make use of various tools and measuring devices, write their specifications, application and care to be taken while using the same.
2. Observe and draw vehicle layout of the following types
 - Two Wheeler
 - Three Wheeler
 - Four Wheeler
3. Dismantle and assemble a single plate dry type clutch assembly, to understand its construction and working. Sketch and label the components.
4. Dismantle and assemble a Multi-plate clutch assembly used in Two Wheelers, to understand its construction and working. Observe the operating linkages and sketch the system.
5. Dismantle and assemble a Synchromesh gear box, to understand its construction and working. Observe gear shifting (synchronizing action), draw power flow diagrams, and calculate gear ratios.
6. Dismantle and assemble Vario-drive. Observe its construction and working. List the components dismantled and draw its sketches.
7. Dismantle and assemble a Propeller shaft, Slip joint and Universal Joint, to understand their construction and working. Sketch the same

8. Dismantle and assemble the Differential and Rear axle, to understand its construction and working. Sketch the unit showing the exact location of the bearings. Find the gear ratio of final drive and state the type of dismantled Rear axle.
9. Dismantle and assemble a Wheel assembly, to understand its construction and working. Observe and sketch tyre and rim. Write specification of Tyre.

Notes: 1) Practicals should be conducted in a group of four students.
2) A number of practicals may be conducted simultaneously.

Learning Resources:

1. Books:-

Sr. No.	Author	Title	Publisher
01	Ramlingam K.K.	Automobile Engineering	Scitech Publication
02	Anil Chikkara	Automobile Engineering Vol. II	Satya Prakashan New Delhi
03	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
04	Harbans Singth Royat	The Automobile	S. Chand Publication
05	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
06	S. Srinivisan	Automotive Mechanics	TATA McGraw – HILL
07	Crouse / Anglin.	Automobile Mechanics	TATA McGraw – HILL

2. Websites:

- www.howstuffworks.co
- www.npkauto.com

5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

Topic I	<p>Name: Vehicle layout and chassis frame</p> <p>Facts: Frame</p> <p>Concepts: Layout of vehicle, Chassis , Basic structure, Power plant, Transmission system, Controls, auxiliaries and super structure</p> <p>Principles: Different loads and its effect.</p> <p>Objectives:</p> <p>1] Students should identify different components of transmission system 2] Student shall locate various components on chassis. 3] Students should identify or draw the chassis of different vehicles</p> <p>Teachers should take students in the transmission lab and demonstrate different models of chassis of different vehicle and narrate the importance of chassis in the building of vehicle.</p> <p>Reference Material: Books:</p> <p>Title: 1) Automobile engineering Vol.I- Dr. Kirpal Singh</p> <p>Teaching Aids: Frames of two and four wheelers, Charts</p> <p>Website: www.google.com (Images Chassis Frame)</p>
Lecture No.	Topic/ Subtopic to be covered
1	Define an automobile and discuss the history of automobile.
2	Elaborate the different types of layout with their application. With the help of charts
3	Discuss the advantages and limitation of each types
4	Identify the different major components of vehicle their location and discuss the function of each component.
5	Discuss the necessity of frame and its functions and different load acting on frame.
6	Explain with figure types of frames- Conventional types and integral types with their application.
7	Discuss the different frame sections –Channel , box, Tubular , Hat and I section.
8	Discuss the materials for frame and also discuss sub frame
Topic 2	Name: Clutches

	<p>Facts: Clutch</p> <p>Concepts: Linkages of operating mechanism</p> <p>Principle: Law of friction.</p> <p>Objectives:</p> <p>1] Students should state the working principle of clutch. 2] Students should identify the different components of clutch and state the function of it 3] Students should identify the different types of clutch and state their specific applications</p> <p>Teachers should bring in the class different models of clutches or show the clutch on cut sectional models of vehicles and state its need and importance.</p> <p>Reference Material: Books:</p> <ol style="list-style-type: none"> 1. Automobile Engineering Vol. I -Dr. Kirpal Singh. 2. Automobile Engineering Vol. II- Anil Chikara <p>Teaching Aids: Single plate clutch, Multi plate clutch , centrifugal clutch Charts, model</p> <p>Website:</p> <ol style="list-style-type: none"> 1) www.youtube.com/watch?v=6BaECAbapRg 2) www.youtube.com/How a clutch works NZ automotive distributors
Lecture No.	Topic/ Subtopic to be covered
1	Define clutch and discuss the necessity of clutch, Illustrate the power flow through the clutch.
2	Classify the clutch – Friction and non friction types.
3	With the help of diagram ,charts and model explain the construction and operation of single plate clutch and give the application of it(Coil and diaphragm) Dry disc clutch.
4	With the help of diagram ,charts and model explain the construction and operation of multi plate clutch and give the application of it
5	With the help of diagram ,charts and model explain the construction and operation of wet clutch , Centrifugal clutch and give the application of it
6	With the help of diagram discuss variator drive.
7	Explain the construction details of clutch plate with the help of charts.
8	Explain mechanical type of clutch operating mechanism.
9	Explain hydraulic and vacuum type of clutch operating mechanism
10	Explain the working principle of fluid coupling and discuss the construction and working.

Topic III	<p>Name: Automotive Gear box.</p> <p>Facts: Gear Box, Selector Mechanism</p> <p>Concepts: Transmission of power through various gears and Lubrication of gear box.</p> <p>Principles: Torque and speed relation used in Gear box.</p> <p>Objectives: 1] Students should able to explain the types of gears and their applications 2] Students should obtain different gear reduction ratio 3] Students should identify the different types of Gear Boxes and its applications.</p> <p>Teachers should expose to the students of cut section model of vehicle mentioning the position of gear box and its types. Like speed reduction, high speed gear box and gear selector mechanism etc.</p> <p>Reference Material: Books: Title: 1) Automobile engineering Vol.I- Dr. Kirpal Singh 2) Automobile engineering- R.B.Gupta</p> <p>Teaching Aids: Gear box constant mesh type, synchromesh type and sliding mesh type ,charts and model</p> <p>Website: www.the autoparts shop.com (you tube)</p>
Lecture No.	Topic/ Subtopic to be covered
1	Discuss the necessity of gear box and types of gear box
2	With the help of charts, ppts and diagrams explain the construction and working of sliding mesh gear box also explain power flow through gear box.
3	With the help of charts, ppts and diagrams explain the construction and working of constant mesh gear box also explain power flow through gear box.
4	With the help of charts, ppts and diagrams explain the construction and working of synchromesh mesh gear box also explain power flow through gear box.
5	Discuss the necessity of torque converter and its construction details
6	Explain the working of torque converter and give the application of it.
7	Explain with the help of chart or model gear selector mechanism
8	Explain with the help of chart or model gear selector mechanism
9	Explain with the help of diagrams or charts working of transfer case.
10	Discuss the lubrication of gear box.
Topic IV	<p>Name: Propeller Shaft</p> <p>Facts: Propeller Shaft, universal joint and slip joint</p> <p>Concepts: Transmission of power through propeller shaft, whirling, Bending</p>

	<p>Principles: Torque transmission at varying angles.</p> <p>Objectives:</p> <p>1] Students should able to explain the function of Propeller shaft 2] Students should identify the different types of joint, viz universal joint and slip joint 3] Students should know the arrangement of propeller shaft in different drive.</p> <p>Teachers should show the model of Propeller shaft and various joints and their use in automotive transmission</p> <p>Reference Material: Books:</p> <p>Title: 1) Automobile engineering Vol.I- Dr. Kirpal Singh 2) Automobile engineering- R.B. Gupta</p> <p>Teaching Aids: Propeller shaft model, Charts.</p>
Lecture No.	Topic/ Subtopic to be covered
1	Discuss the necessity of propeller shaft and power transmission through propeller shaft.
2	Explain the rear axle drive-Torque tube drive with the help of diagrams.
3	Explain the rear axle drive Hotchkiss drive with the help of diagrams
4	Explain the construction and operation of propeller shaft.
5	Explain the functions of universal joint , slip joint, rezappa joint and tripod joint.
6	Explain with sketch divided propeller shaft.
Topic V	<p>Name: Differential and rear axle.</p> <p>Facts: Differential, rear axle.</p> <p>Concepts: Final drive, power transmission through differential and rear axle.</p> <p>Principles: Principle of differential, Loads acting on vehicle</p> <p>Objectives:</p> <p>1] Students should know the necessity and working principal of Differential. 2] Students should explain the functions of Differential and rear axle.</p> <p>Teachers should show the model of Differential and rear axle.</p> <p>Reference Material: Books:</p> <p>Title: 1) Automobile engineering Vol.I- Dr. Kirpal Singh 2) Automobile engg. –R.B.Gupta.</p>

	<p>Teaching Aids: Model of differential and rear axle ,charts</p> <p>Website: grewal.wikispaces.com/file/view/How+ differential+works</p>
Lecture No.	Topic/ Subtopic to be covered
1	Discuss the necessity of the differential and also discuss power flow through the differential.
2	Discuss the different types of differential.
3	Explain the construction and working of final drive and differential.-bevel & spur type.
4	Explain the concept of differential lock and double reduction differential.
5	Discuss the necessity of rear axle and different load acting on the rear axle.
6	Explain with sketches semi floating and full floating type rear axle.
7	Explain the concept of double reduction axle.
8	Explain with diagram split and banjo type rear axle casing.
Topic VI	<p>Name: Wheels and Tyres.</p> <p>Facts: Wheels and Tyres.</p> <p>Concepts: Tyre wear and Tyre defects.</p> <p>Objectives:</p> <p>1] Students should able to classify different types of Wheels and Tyres. 2] Students should know the different types of tyre treads and their applications. 3] Students should able to select proper type Wheels and tyres for a specific applications.</p> <p>Teachers should show the actual sample of Wheels and cut section of tyres</p> <p>Reference Material: Books:</p> <p>Title: 1) Automobile engineering Vol.I- Dr. Kirpal Singh</p> <p>Teaching Aids: Two wheeler and four wheeler Tyre cut section, charts of tyre</p> <p>Website: www.google.com (Images Wheels), www.google.com (Images Tire construction) and www.google.com (Images Tire Wear)</p>
Lecture No.	Topic/ Subtopic to be covered
1	Explain function of wheels and discuss the types of wheels
2	Explain the construction of wheels-Wired spoke wheel, disc and alloy wheels
3	Discuss the necessity of tyres and explain with sketches construction and working of tubed tyre and tubeless tyres
4	Compare tubed and tubless tyres and explain with sketches radial ,cross ply and belted bias type.
5	Discuss the specification of tyres and aspect ratio
6	Discuss the types of tread patterns and explain the effect of inflation of pressure on the life of tyre and tyre rotation.with sketches.

5.2 Planning and Conduct of Test:

Class test should conduct as per schedule given by board, total two tests each of 25 marks were conducted in a semester

5.3 Details about conduct of assignments:

1. Identify the vehicle layout of different types of vehicle available in the market. Teacher shall specify the various models of vehicle available in market.
2. Identify the clutch used in various vehicles and state the different components of it.
3. Identify the different gear box used in various vehicles. Teacher shall specify the various models of vehicle available in market.
4. Identify the different tyre treads used on tyre and its significance also state the effect of tyre inflammation.

5.4 Strategies for Conduct of Practical:

5.4.1 Approach for design of Manual:

Teacher should read the teacher guide line in manual and conduct the practical as per lab manual. Assign the questions to the students and take viva on it.

5.4.2 Suggestions for effective conduct of practical and assessment:

Teacher shall complete the theoretical portion of practical first and aware the student about different model available in the lab. If it is not available then arranged visits to various garages. Teacher should assess the practical on the basis of 4+4+2=10 marks to each practical.

5.4.3 Preparation for conduct of practical

- 1) Expt. 1- Teacher should make available all the tools and student should identify its Application at various location of vehicle and also state the materials of tools.
- 2) Expt.2- Two wheeler, Three wheeler and four wheeler model shall available in lab and Student should identify the model, their application and also compare it.

3) Expt.3- Student should observe the single plate clutch, disassemble the clutch, identify the components of it, state the function of it and then assembled it. Teacher should observe the assembled clutch plate and asked the question to every Student.

4) Expt.4- Same as above procedure is adopting for this practical.

6. Mode of assessment:

6.1 Class Test:

- Discuss the class test question paper and its model answer in the class.
- Display the model answers of class test question paper on notice board.
- Assessment of the test papers shall be done by highlighting the mistakes.
- Test papers should be shown to students.
- Teacher shall give the feedback to students about their performance.
- Tests marks should be displayed on the notice board.
- Test marks should be entered in the test mark register.

6.1.1 Guidelines for Setting Class Test Question Paper:

- The questions in the test paper shall be strictly as per the Dr. Bloom's revised taxonomy, described earlier.
- Sample class test paper given in this guideline should be refer before setting question paper.
- The question paper must have minimum three levels (remember, understand and analyse/ apply) of cognitive domain proposed by Dr. Bloom.
- There should be three questions with Q. 1 of 9 Marks, Q. 2 and Q. 3 of 8 marks each.
- Q. 1 will have 4 bits of 3 marks each and student will have to attempt any three
- Q.2 and Q.3 will have either 3 Bits of 4 marks each and students will attempt ant two

6.1.2 Sample Test Papers:

Sample Test Paper 1

Roll No.				
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17307

Institute Name:

Course Name: Diploma in automobile Engineering

Course Code: AE

Semester: Third

Subject: Vehicle Layout and transmission system

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

3x3=9

- a) State different chassis layout and its application.
- b) Explain necessity of clutch and state its types.
- c) State the function of a tractor case with example.
- d) State necessity of frame and its functions.
- e) How a torque converter differs from a gear box.

Q2. Attempt any Two of the following

4x2=8

- a) Explain with labeled sketch chassis layout of four wheel drive.
- b) Describe construction and working of synchromesh gear box.
- c) Explain working of centrifugal clutch with neat sketch.

Q3. Attempt any Two of the following

4x2=8

- a) Explain general chassis layout with neat sketch.
- b) Explain construction and working of constant mesh gear box with neat sketch.
- c) Compare between a dry clutch and wet clutch on the basis of construction, torque transmission, and heat dissipation and application.

Sample Test Paper 2

Roll No.

17307

Institute Name:

Course Name: Diploma in automobile Engg.

Course Code: AE

Semester: Third

Subject: Vehicle Layout and transmission system

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

3x3=9

- a) State functions of propeller shaft and list its components.
- b) Explain the concept of double reduction axle.
- c) List main types of wheel and tyre.
- d) State the functions of universal joint and slip joint.
- e) Give the meaning of a differential lock and its uses.

Q2. Attempt any Two of the following

4x2=8

- d) Explain construction and working of a torque tube drive.
- e) Explain with neat sketch working of a full floating axle.
- f) Distinguish between a tube tyre and tubeless tyre.

Q3. Attempt any Two of the following

4x2=8

- d) Explain rezappa joint and tripod joint.
- e) Describe construction and working of a differential.
- f) Explain effect of inflation pressure on tyre life.

6.2.3 Sample Question Paper:

Exam Seat No.									
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Subject Code

Maharashtra State Board of Technical Education

Course Name: Automobile Engineering

Course Code: AE

Semester: Third

Title of the Subject: Vehicle Layout and Transmission System Subject Code: 17307

Marks: 100

Time: 3 Hrs

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

Q.1(A) Attempt any Six

12

- (a) Define Automobile Engineering.
- (b) State materials used for frame manufacturing.
- (c) State application of frame-channel section and box section one each
- (d) State the location of clutch in an automobile.
- (e) List any four components of gear box.
- (f) List any two advantages and disadvantages of propeller shaft.
- (g) List any four components of differential
- (h) What are different types of rear axle(any two)

Q.1 (B) Attempt any Two

08

- (a) Explain with neat sketch Hotchkiss drive
- (b) What are different loads acting on the rear axle
- (c) Differentiate between tube type and tubeless type

Que.2 Solve any Four

16

- (i) Explain the concept of differential Lock.
- (ii) State the function of universal joint and slip joint.
- (iii) Explain with neat sketch construction and working of torque converter.
- (iv) Why clutch is used in automobile? State material used for clutch lining.
- (v) Explain with sketch construction and operation of constant mesh gear box.
- (vi) Complete fig. 1, labeled it and identify the layout of vehicle.

Q.3 Solve any Four

16

- (i) Explain with neat sketch construction and working of single plate diaphragm type clutch.
- (ii) With block diagram explain hydraulic clutch operation mechanism.
- (iii) Differentiate between single plate clutch and multiplate clutch.
- (iv) Explain construction and working of transfer case. State its applications.
- (v) Explain with sketch synchromesh device used in gear box.
- (vi) Describe synchronizer unit with neat sketch.

Q.4 Solve any Four

16

- (i) Classify clutch, and state specific applications of each clutch.
- (ii) State two advantages and two disadvantages of synchromesh gear box.
- (iii) Explain the necessity of gear box in an automobile.
- (iv) Explain construction and working of clutch plate with neat sketch.
- (v) Explain construction and working of Fluid coupling with labeled sketch
- (vi) State function of wheel Explain alloy wheel.

Q.5 Attempt Any Two

16

- (i) What are different types of tyres and state the different causes of tyre wear.
- (ii) Explain the effect of inflation pressure on the life of tyre.
- (iii) Describe construction and working principle of Differential.

- (i) With neat sketch explain semi floating and full floating type rear axle
- (ii) Draw any two four wheeler vehicle Layout, state advantages and limitations.
- (iii) Describe with sketch construction and operation of propeller shaft.

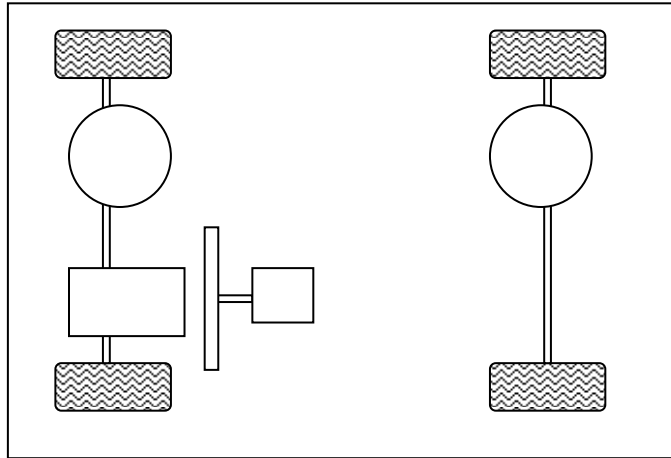


Fig. 1