

CURRICULUM REVISION PROJECT

2012

**TEACHER GUIDE FOR
(TWO WHEELER TECHNOLOGY 17521)
FIFTH SEMESTER
AUTOMOBILE ENGINEERING GROUP**

JUNE 2014



**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.

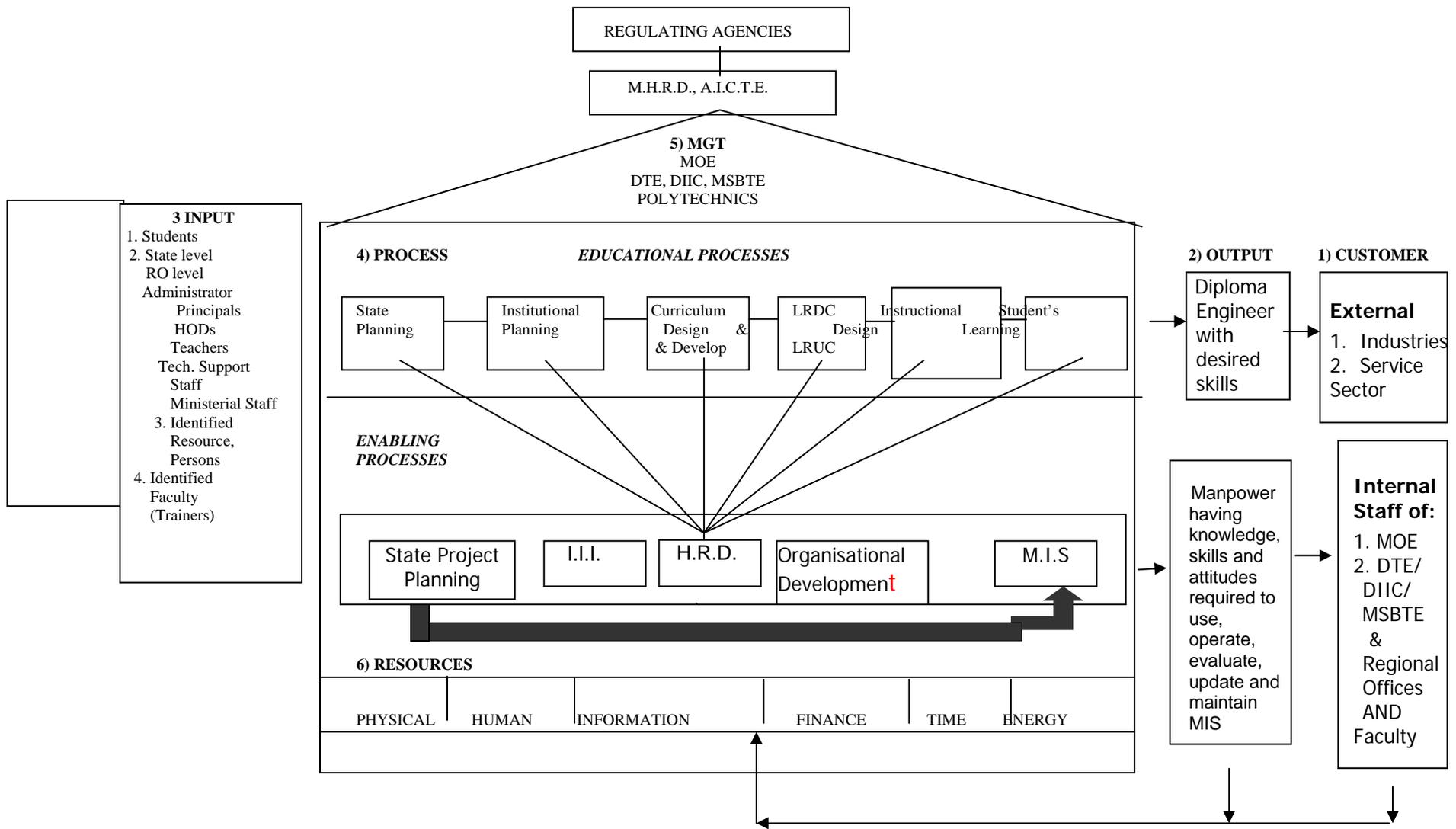


Fig 1 Systems Approach

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 intellectual and motor skills in order to satisfactorily perform duties assigned to them. It is required that each group should put the skills as identified in Scheme G.

A) Intellectual skills.

1. Observe, compare and describe two wheelers on basis of Aerodynamics, Aesthetics and Ergonomic considerations for their merits and demerits.
2. Understand the functions of various parts of a two wheeler body.
3. Understand various systems of a two wheeler. Use various facilities available in an advanced two wheeler

B) Motor Skills.

- 1) Clutch cable free play adjust, replace, dismantling, assembling
- 2) Carburetor tuning, idle speed adjust, air filter cleaning
- 3) Adjusting brake shoes, free play for brake lever/pedal
- 4) Checking electrical system components.
- 5) Cleaning spark plug, checking ignition timing.

1.6 Salient Changes in the curriculum:

- ❖ For First Semester Basic Science is divided into two parts- Basic Physics and Basic Chemistry. Theory examination of both parts as well as practical examination of both parts will be conducted on separate days. Sum of theory marks of both parts shall be considered for passing theory examination of Basic Science. Similarly it is applicable to practical examination. It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- ❖ For second semester Applied Science is divided into two sections- Applied Physics and Applied Chemistry where the theory examination of 50 marks each and practical examination of 25 Marks each will be conducted separately and the minimum passing marks for Applied Science will be the combination of both the sections. . It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- ❖ The components of Development of Life Skills were taught in two semesters. In Development of Life Skills –I the topics related to personal development, such as Learning to Learn Skills, personality development, presentation skills etc. were included. In Development of Life Skills – II the topics related to Team Building, Leadership, group behavior etc. were covered. In the revised curriculum the scope of development of life

skills has been broadened 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 viz. Third, fourth and fifth semesters.
- ❖ Introduction of Environment Studies at fourth Semester for all courses
- ❖ From the experience of implementation of Elective Subjects at V and VI semesters in last five years, it is proposed to have only one elective at the sixth semester for all courses. However the specialized courses like Medical Electronics, Electronics and Video Engineering will not have provision for electives. For elective, student will have to choose one from the given two/three subjects.
- ❖ While revising the curriculum redundant /obsolete topics/sub topics are being replaced by new/advance technology topics/sub topics.
- ❖ In Civil Engineering Group CAD and Building Materials have been added as an independent subject. Topics on Airport Engineering and Docks and Harbours have been added in the subject Transportation Engineering.

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:

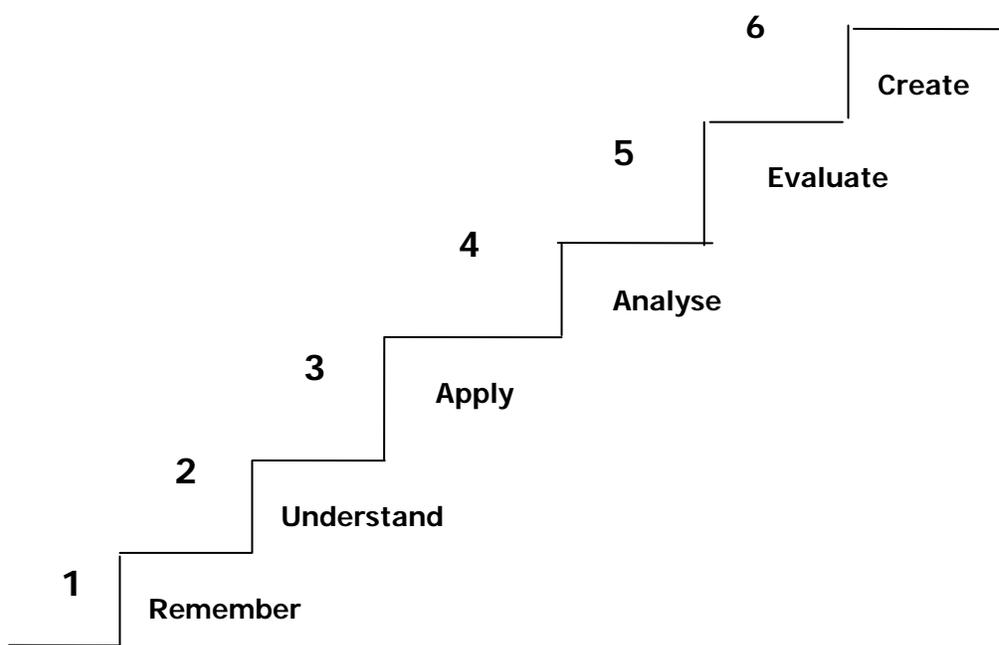
Question paper is a tool/ instrument designed to test the extent of learning of the student. Various questions set in a question paper should assess the abilities of students to respond to level of learning. Dr. Bloom a German educationist classified levels of learning in cognitive domain for the purpose 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	Knows common terms, specific facts, basic	Define, describe, identify label, list,

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	concepts, principles, methods & procedures	match, name, outline, reproduce, select, state
Understand – This is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words or numbers) by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). Draw sketches these learning outcomes go one step beyond the simple remembering of material and represent the lowest level of understanding.	Understands fact, principles Interprets verbal material, Interprets charts, tables, graphs. Translates verbal material to mathematical formula. Estimates consequences implied in data. Justifies methods & procedures.	Convert, distinguish estimate, explain, extend, generalize, give examples; infer, paraphrase, predict, rewrite, summarize, draw labeled sketches.
Apply – Application refers to the ability to use learned material in new and concrete situations. This may include the application of such things as concepts, principles, rules, methods, laws and theories. Learning outcomes in this area require a higher level of understanding than those under the level described earlier.	Applies principles to new situations. Applies theories to practical situations. Solves mathematical problem. Construct charts, graphs Demonstrates correct usage of a procedure	Change, compile, demonstrate, discover manipulate, modify operate, predict, prepare, produce, show, solve, use.
Analyze – Analysis refers to the ability to break down material into its component parts so that its organizational structure may be understood. This may include the identification of the parts, analysis of the relationship between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than “understand” and apply because they require an understanding of both the content and the structural form of the material.	Recognizes unstated assumptions and logical fallacies in reasoning. Distinguishes between facts and inferences. Evaluates relevance/ adequacy of data.	Breakdown, diagram, differentiate, discriminate, distinguish, identify illustrate, infer, outline, point out, relate, select, separate, subdivide.

2.4.2 Categories of Knowledge Dimension

After considering the various designations of knowledge types, especially developments in cognitive psychology that have taken place since the original framework of Bloom’s

taxonomy, knowledge is categorised in 4 types – Factual , Conceptual, Procedural and Meta-cognitive.

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

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

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

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

Assessment is required to be done on the basis of categories of knowledge and levels of learning. Table below indicates the two dimensional grid based on Blooms Taxonomy for setting questions.

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

2.5 Components of Curriculum:

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

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

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

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

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

2.5.3 Learning Structure: It graphically/pictorially indicates the content of the curriculum of the subject and what is to be learnt in the subject. As you know that Cognitive Domain knowledge is divided in four components as mentioned in the Two dimensional grid. Of this Factual, Conceptual and Procedural knowledge components are identified in the curriculum of the subject along with the applications.

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

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

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

The skills will be developed if the students actually perform certain activities or tasks. Therefore it is necessary that any practical included in the curriculum necessarily involve some activities to be done by the students. So one has to think and innovate to modify the study experiments so that students will be asked to perform some activity. It could be in terms of identifying components, listing of materials used for manufacturing the components, stating importance of use of certain materials etc.

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

3. 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 : Fifth

Subject Title : Two Wheeler Technology

Subject Code : 17521

Teaching and Examination Scheme:

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

NOTE:

> Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.

> Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

Rationale:

There is an increased need of public transport. The public transport systems in cities and in rural area do not meet the requirement effectively. This has led to huge demand of two wheelers.

Presently the two wheelers are used by a large section of society as personalized transport. In view of the growth, large employment potential in this field and the manpower required to cater to the same, this subject is included as an elective subject.

General Objectives:

Students will be able to

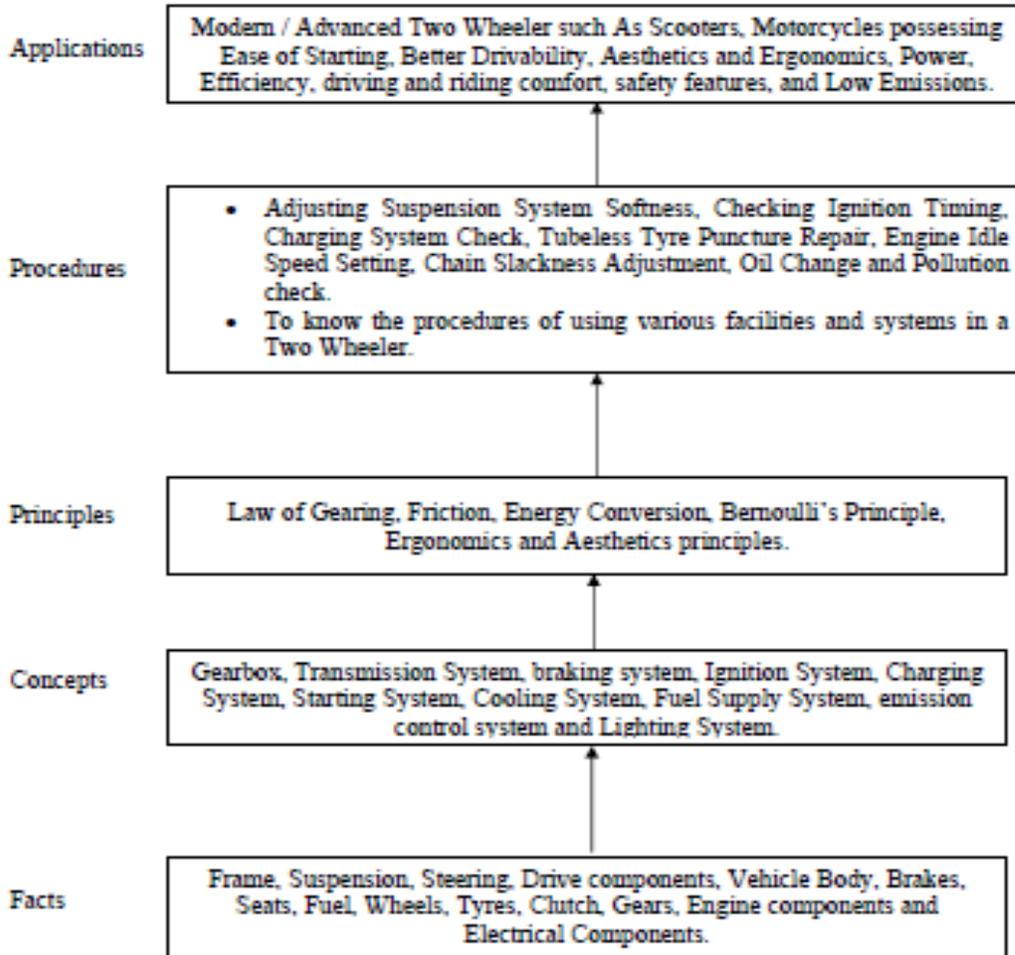
1. Carry out the recommended procedures of the servicing using a service manual.
2. Select a suitable two wheeler for specific requirements of user.
3. Understand various mechanical, electrical and electronic systems and modern features used in two wheelers.

Learning Structure:

w.e.f Academic Year 2012-13

'G' Scheme

Learning Structure:



Theory:**Topic and Contents****Hours Marks**

Topic and Contents	Hours	Marks
<p>1: Frames, Body and Transmission system</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Know various types of frames, bodies, select a suitable type of frame for particular application. ➤ Compare types of clutches, gearboxes and their applications. <p>Contents:</p> <p>1.1 Type of frames 04Marks</p> <ul style="list-style-type: none"> • Single cradle frame, Double cradle frame, Tubular frame (Single Down-tube frame using the engine as a stressed member), • Body- Monocoque Construction. <p>1.2 Selection of Transmission system components. 04Marks</p> <ul style="list-style-type: none"> • Cable Actuated Wet Multi-disc clutch, Centrifugal clutch. • Chain drive, Belt drive with variator mechanism, Gear drive. <p>1.3 Working of Gear box, its comparison with four wheelers. 04Marks</p> <ul style="list-style-type: none"> • Gear ratios in scooter and motorcycle. • Working of Constant mesh gear box. 	05	12
<p>2: Engines, Fuel Supply System, Lubrication System and Emission Control System</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand engine features and its working. ➤ Understand working of Induction system, Exhaust System, Fuel Supply System, Lubrication System and Emission Control System. <p>Contents:</p> <p>2.1 Induction and Exhaust system. 18 Marks</p> <p>Induction System</p> <ul style="list-style-type: none"> • Air filter/ Air Cleaner: construction and function - Washable oiled sponge element, washable Dual foam wet type. • Two Stroke Engines - Arrangement of Ports in the cylinder, Decompression Valve arrangement. • Four Stroke Engines - Overhead Valve and Overhead cam arrangements. <p>Advantages of Multiple valves.</p> <p>Fuel supply system</p> <ul style="list-style-type: none"> • Gravity feed and vacuum operated system. • Down draught and horizontal/ Side draught carburetor. • Carburetor functions and working under various Engine operating conditions like - Idling, Starting, accelerating, normal running. • Advantages of electronic fuel injection system. <p>Exhaust system</p> <ul style="list-style-type: none"> • Construction and function of Exhaust system: Header pipe, Muffler Types and their application, Tail Pipe arrangement and location. <p>2.2 Lubrication and Emission Control Systems 10 Marks</p> <p>Lubrication system.</p> <ul style="list-style-type: none"> • Petrol Lubrication with Separate Oil Pump for Two stroke engines. • Wet sump Pressurized Lubrication in four stroke engines. Block diagram and working of pollution control measures • Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation. 	13	28
<p>3: Steering and Suspension System</p> <p>Specific Objectives:</p>	04	08

<p>➤ Know types of front and rear suspension system and steering System.</p> <p>Contents:</p> <ul style="list-style-type: none"> • Handle Bar arrangement, Steering fork, Purpose of providing Caster angle. • Use of Dampers/ Double acting type of shock absorbers. • Use of Variable Rate coil spring, Coil in coil spring arrangement. • Advantages of Mono-shock suspension system. • Advantage of Gas filled shock absorber for rear end suspension. 		
<p>4: Brakes, Wheels and Tyres.</p> <p>Specific Objectives:</p> <p>➤ Understand types of braking system, types of wheels and modern tyres.</p> <p>Content :</p> <ul style="list-style-type: none"> • Drum (Mechanical Expanding Shoe type) and disc Brakes (Fixed Caliper and Floating Caliper types.) • Mechanical and Hydraulic brakes. • Lever operated and pedal operated brakes. • Application and criteria for selection of wheels and tyres, their specification for motorcycles, scooters, sports bike. 	04	08
<p>5: Electrical System</p> <p>Specific Objectives:</p> <p>➤ Know types of ignition and other electrical systems.</p> <p>Contents :</p> <p>5.1 Ignition System 08 Marks</p> <ul style="list-style-type: none"> • Working of Condenser Discharge Ignition (CDI) system. • Microprocessor controlled Ignition system block diagram and working. • Benefits of Twin Spark Ignition system <p>5.2 Starting system and Charging System 08 Marks</p> <ul style="list-style-type: none"> • Kick Start and Button Start arrangements. Components of starting system and their functions: D C motor, Battery, Battery Rating for use in Button start vehicles. • Schematic circuit and working of charging system. Schematic diagram showing AC and DC circuits. <p>5.3 Lighting System and accessories- 08 Marks Specifications and Application of</p> <ul style="list-style-type: none"> • Head Lamp, Tail and number plate Lamp, Purpose of using LED lights in tail lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp, • Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers. <p>Dash units</p> <ul style="list-style-type: none"> • Use of Speedometer (Analog and digital), Trip meter. • Use of Engine Speed indicator/ Tachometer. 	12	24
<p>6: Aerodynamics, Ergonomics, Aesthetics and Safety Aspects.</p> <p>Specific Objectives :</p> <p>➤ Understand Aerodynamics, Aesthetics and Ergonomic aspects of a two wheeler.</p> <p>Contents :</p> <p>6.1 Aerodynamic Aspects 04 Marks</p> <ul style="list-style-type: none"> • Head lamp shape (Sealed beam and conventional). • Tail lamp and indicator light arrangements- body enclosed and separate. • Shape of Fuel Tank in Motorcycles <p>6.2 Ergonomic and Aesthetic Aspects 12 Marks</p> <p>Ergonomic Aspects</p> <ul style="list-style-type: none"> • Seat Arrangement for rider and pillion rider • Handle bar position. 	10	20

<ul style="list-style-type: none"> • Floor/ Foot rest for driver and pillion rider, Aesthetic Aspects • Headlamp fairing of motorcycles. • Side panels for scooter/ scooterate and motorcycle. • Ground clearance. • Mud guard shape and position. 		
6.4 Safety Aspects	04 Marks	
<ul style="list-style-type: none"> • Crash bar, Saree guard • Driving Habits. • Drive gear - Jacket, Helmet, Day night goggle. 		
Total	48	100

Practical:

Skills to be developed: Intellectual Skills:

1. Observe, compare and describe two wheelers on basis of Aerodynamics, Aesthetics and Ergonomic considerations for their merits and demerits.
2. Understand the functions of various parts of a two wheeler body.
3. Understand various systems of a two wheeler. Use various facilities available in an advanced two wheeler

Motor Skills:

1. Adjust the idling speed of two wheeler engine. Perform clutch and brake adjustment.
2. Check parameters like tyre inflation, battery voltage, charging voltage of a two wheeler.

List of Practicals:

1. Observe and sketch the layout of a two wheeler transmission system.
2. Check the following electrical / electronic components, parameters of a two wheeler.
 - CDI system components,
 - Charging System components,
 - Voltage at battery, specific gravity and high discharge test Use service/ operators manual for specifications.
3. Adjust idle speed of a two wheeler engine using the specified procedure. Check the Idling Emission using Exhaust Gas Analyzer and do necessary carburetor adjustments for better performance.
4. Check the Ignition Timing of a two-wheeler and compare it with the Workshop/ Operators Manual Specification. Remove, observe, clean the Spark plug and adjust the gap and refit.
5. Remove and refit rear wheel of a two wheeler - check the conditions of brake shoes, brake drum, bearings etc. Perform brake adjustment. Replace brake cables, brake shoes/ pads.
6. Visit a Two wheeler Dealer Showroom/ Company showroom to obtain Chassis specification of a Scooter/ Motorcycle or scooterate. Share and Compare the data collected for two vehicles in the same category of vehicles (on the basis of Ground clearance, wheel base, engine power, spare wheel, claimed fuel efficiency, load carrying capacity). Prepare a report to identify the better one in the category.
7. Dismantle and assemble a motorcycle clutch and perform clutch adjustments. Replace clutch cable, if required.
8. Carry out lubrication and greasing of a vehicle.
 - Engine, brake linkage, clutch linkage, fork, axle, chain and levers.

Notes:

1. Practicals to be conducted in a group of 4 to 6 students.
2. Number of practicals shall be conducted simultaneously.

List of Assignments:

1. Report all the salient features of a latest two wheeler. Describe the technical and ergonomic features, if information is available. Comment on the aesthetics of the vehicle. Separate models should be considered by a group of four students.
2. Prepare troubleshooting chart for failure of a two wheeler system. (Symptoms, Causes and remedies)

Learning Resources: 1. Books:

Sr. No.	Author	Title	Publisher, Edition
1	--	Service Manuals of Popular Indian Two Wheeled Vehicles.	--
2	K.K. Ramalingam	Two wheelers.	SCITECH-I
3	R.B. Gupta	Automobile Engineering	--
4	K.K. Ramalingam	Automobile Engineering.	SCITECH-II

2. Websites: Wikipedia, How Stuff Works,

5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

Topic I	Name: Frames, Body and Transmission system		
	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	Frame, chain, Belt, Gear, Clutch plate	Show the various components of two wheeler in the lab. Make use of PPTs for better understanding of students.
	CONCEPT	Gearbox, Gear ratio, Drives	Explanation with chalk & board initially. Make use of PPTs of component & assembly. Explain the function, construction and working of frames and transmission system components. Ask student to observe various frames and transmission system from cut sections of transmission system of two wheelers.
	PRINCIPLE	Lubrication	Explain with figures and ppts, the details regarding the lubrication of clutch operating mechanism, multi-plate clutch, chain drive and gear box.
	PROCEDURE	Clutch adjustment	Explain clutch adjustment procedure as per manufacture's workshop manual. Explanation with PPTs and videos to the students for better understanding.
APPLICATION	Transmission system of various two wheeler	Explanation with chalk & board or PPTs initially. Explain the various types of transmission system and working of Constant mesh gear box, using the actual systems or videos. Use of exploded views from the workshop manual may be done for better understanding of students.	
Learning Resources: Learning Resources: Books , Charts ,Models and PPTs			
Books: 1) Dr. Kripal Singh- Automobile engine Vol.2			
Title 2) Anil Chikara- Automobile engineering Vol.1			
3) R.B.Gupta- Automobile engineering			
4) K.K.Ramlingam- Two wheelers : Theory, Maintenance & Operation			
5) Service Manuals of various two wheelers.			

	<p>Teaching Aids: Charts of two wheeler frame types, Cut section models of 2-Stroke and 4-Stroke Engine & Crankcase, Working model of valve mechanism and model or charts of various drives and transmission system layout.</p> <p>PPTs with Sample: Types of Frames, Layout of cable actuated multidisc clutch, Types of primary drive, gear ratios of two wheeler & constant mesh gear box.</p> <p>Websites: www.slideshare.net www.howstuffworks.com www.youtube.com www.npkauto.com</p>												
Lecture No.	Topic/ Subtopic to be covered												
1 & 2	<p>1.1 Type of frames</p> <ul style="list-style-type: none"> • Single cradle frame, Double cradle frame, Tubular frame (Single Down-tube frame using the engine as a stressed member), • Body- Monocoque Construction. 												
3 & 4	<p>1.2 Selection of Transmission system components.</p> <ul style="list-style-type: none"> • Cable Actuated Wet Multi-disc clutch, Centrifugal clutch. • Chain drive, Belt drive with variator mechanism, Gear drive. 												
5	<p>1.3 Working of Gear box, its comparison with four wheelers</p> <ul style="list-style-type: none"> • Gear ratios in scooter and motorcycle. • Working of Constant mesh gear box. 												
Topic 2	<p>Name: Engines, Fuel Supply System, Lubrication System and Emission Control System</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> <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>Air filter, oil, valves, jets</td> <td>Show the cut section models for observation of induction system of a two wheeler. Make use of PPTs for better understanding of students.</td> </tr> <tr> <td>CONCEPT</td> <td>Carburetor, engine</td> <td>Explanation with chalk & board initially. Make use of PPTs of carburetor operations under different conditions. Explain the working of 2-stroke and 4-stroke engine, decompression valve. Ask student to observe two wheeler engine cut sections for better understanding.</td> </tr> <tr> <td>PRINCIPLE</td> <td>Automization and venturi principle</td> <td>Explain with figures using transparencies, PPTs or videos the details regarding the working of carburetor under different conditions.</td> </tr> </tbody> </table>	Knowledge Category	Example/s of category	Teaching methodology	FACT	Air filter, oil, valves, jets	Show the cut section models for observation of induction system of a two wheeler. Make use of PPTs for better understanding of students.	CONCEPT	Carburetor, engine	Explanation with chalk & board initially. Make use of PPTs of carburetor operations under different conditions. Explain the working of 2-stroke and 4-stroke engine, decompression valve. Ask student to observe two wheeler engine cut sections for better understanding.	PRINCIPLE	Automization and venturi principle	Explain with figures using transparencies, PPTs or videos the details regarding the working of carburetor under different conditions.
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PRINCIPLE	Automization and venturi principle	Explain with figures using transparencies, PPTs or videos the details regarding the working of carburetor under different conditions.											

	PROCEDURE	Idle Speed setting, air filter cleaning	The specified procedure should be implemented during practical session.
	APPLICATION	Systems like fuel supply, lubrication and emission	Explanation with chalk & board or PPTs . Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.
<p>Learning Resources: Learning Resources: Books , Charts ,Models and PPTs</p> <p>Books: 1) Dr. Kripal Singh- Automobile engine Vol.2 Title 2) Anil Chikara- Automobile engineering Vol.1 3) R.B. Gupta- Automobile engineering 4) K.K. Ramlingam- Two wheelers : Theory, Maintenance & Operation 5) Service Manuals of various two wheelers.</p> <p>Teaching Aids: Charts of two wheeler engine cut section, Fuel Supply system, carburetors, Lubrication, catalytic convertor & PCV system. Cut Sections of two wheeler silencer-with catalytic convertor may be used.</p> <p>PPTs: Induction system, exhaust system, valve arrangements & multiple valves, Lubrication and Emission Control system.</p> <p>Websites: www.slideshare.net www.howstuffworks.com www.youtube.com www.npkauto.com</p>			
Lecture No.	Topic/ Subtopic to be covered		
1	2.1 Induction and Exhaust system. Induction System <ul style="list-style-type: none"> Air filter/ Air Cleaner: construction and function - Washable oiled sponge element, washable Dual foam wet type. 		
2	<ul style="list-style-type: none"> Two Stroke Engines - Arrangement of Ports in the cylinder, Decompression Valve arrangement. 		
3	<ul style="list-style-type: none"> Four Stroke Engines - Overhead Valve and Overhead cam arrangements. Advantages of Multiple valves. 		
4	Fuel supply system <ul style="list-style-type: none"> Gravity feed and vacuum operated system. 		
5	<ul style="list-style-type: none"> Down draught and horizontal/ Side draught carburetor. 		
6 & 7	<ul style="list-style-type: none"> Carburetor functions and working under various Engine operating conditions like – Idling, Starting, accelerating, normal running. 		

8	<ul style="list-style-type: none"> Advantages of electronic fuel injection system. 																		
9	<p>Exhaust system</p> <p>Construction and function of Exhaust system: Header pipe, Muffler</p> <p>Types and their application, Tail Pipe arrangement and location</p>																		
10	<p>2.2 Lubrication and Emission Control Systems</p> <p>Lubrication system.</p> <ul style="list-style-type: none"> Petroil Lubrication with Separate Oil Pump for Two stroke engines. Wet sump Pressurized Lubrication in four stroke engines. 																		
11 & 12	<p>Block diagram and working of pollution control measures</p> <ul style="list-style-type: none"> Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation. 																		
Topic 3	<p>Name: Steering and Suspension System</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> <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>Spring, Oil, Steering fork</td> <td>Show the suspension and steering system of two wheeler. Cut section models of shock absorber. Show Various types of spring and there arrangements Make use of PPTs for better understanding of students.</td> </tr> <tr> <td>CONCEPT</td> <td>Steering, caster, self-rightening torque</td> <td>Explanation with chalk & board initially. Explain the concept of Caster and self-rightening torque. Ask student to observe the arrangement of fork in various motorcycle for better understanding.</td> </tr> <tr> <td>PRINCIPLE</td> <td>Damping</td> <td>Explain with figures using transparencies, PPTs or videos the details regarding the working of Damper.</td> </tr> <tr> <td>PROCEDURE</td> <td>Adjustment of rear damper stiffness</td> <td>Explain adjustment procedure of rear damper stiffness. Refer manufacture's workshop manual. Explanation with PPTs and videos to the students for better understanding.</td> </tr> <tr> <td>APPLICATION</td> <td>Suspension and steering system</td> <td>Explanation with chalk & board or PPTs . Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.</td> </tr> </tbody> </table> <p>Learning Resources: Learning Resources: Books , Charts ,Models and PPTs</p>	Knowledge Category	Example/s of category	Teaching methodology	FACT	Spring, Oil, Steering fork	Show the suspension and steering system of two wheeler. Cut section models of shock absorber. Show Various types of spring and there arrangements Make use of PPTs for better understanding of students.	CONCEPT	Steering, caster, self-rightening torque	Explanation with chalk & board initially. Explain the concept of Caster and self-rightening torque. Ask student to observe the arrangement of fork in various motorcycle for better understanding.	PRINCIPLE	Damping	Explain with figures using transparencies, PPTs or videos the details regarding the working of Damper.	PROCEDURE	Adjustment of rear damper stiffness	Explain adjustment procedure of rear damper stiffness. Refer manufacture's workshop manual. Explanation with PPTs and videos to the students for better understanding.	APPLICATION	Suspension and steering system	Explanation with chalk & board or PPTs . Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.
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	APPLICATION	Braking System, tyre rolling	Explanation with chalk & board or PPTs. Explain the use of caster angle for stability of steering at speeds. Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.									
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	PRINCIPLE	Energy Conversion	Explain the principle of conversion of electrical energy to chemical energy to mechanical energy / light or spark.
	PROCEDURE	--	--
	APPLICATION	Electrical System	Explanation with chalk & board or PPTs. Explain the use of Mechanical and Button Start arrangements. Explain the use of various lamp used in a two wheeler. Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.
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10	<ul style="list-style-type: none"> • Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers. 																		
11	<p>Dash units</p> <ul style="list-style-type: none"> • Use of Speedometer (Analog and digital), Trip meter. • Use of Engine Speed indicator/ Tachometer 																		
Topic 6	<p>Name: Aerodynamics, Ergonomics, Aesthetics and Safety Aspects 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> <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>Head lamp, Fuel Tank, Seat and Handle bar</td> <td>Show the PPTs of types of Headlamp, Tail lamp, Indicator and Fuel tank shape. Actual Components may be shown.</td> </tr> <tr> <td>CONCEPT</td> <td>Ground Clearance, Safety</td> <td>Explain the importance of ground clearance as applied to road conditions with pothole and Bumps, using chalk & board or PPTs. Explain the concept of safety of rider and pillion rider in relation to drive gear, driving habits and guards.</td> </tr> <tr> <td>PRINCIPLE</td> <td>Aerodynamic and Ergonomic Principles</td> <td>Explain the Aerodynamic and Ergonomic Principles applied to the seat, handle bar, foot rest and shape of fuel tank.</td> </tr> <tr> <td>PROCEDURE</td> <td>--</td> <td>--</td> </tr> <tr> <td>APPLICATION</td> <td>Aesthetically, ergonomically and aerodynamically designed two wheeler</td> <td>Explain a two wheeler features as regards aesthetics, ergonomics and aerodynamics using PPTs or Videos. Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.</td> </tr> </tbody> </table> <p>Learning Resources: Learning Resources: Books , Charts ,Models and PPTs</p> <p>Books: 1) Dr. Kripal Singh- Automobile engine Vol.2 Title 2) Anil Chikara- Automobile engineering Vol.1 3) R.B.Gupta- Automobile engineering 4) K.K.Ramlingam- Two wheelers : Theory, Maintenance & Operation 5) Service Manuals of various two wheelers.</p> <p>Teaching Aids: Use of two wheeler manufacturer’s website & Relevant website data for preparation of PPTs based on Aesthetic, ergonomic and aerodynamic design</p> <p>PPTs: Aesthetic, ergonomic and aerodynamic design</p> <p>Websites: www.slideshare.net www.howstuffworks.com</p>	Knowledge Category	Example/s of category	Teaching methodology	FACT	Head lamp, Fuel Tank, Seat and Handle bar	Show the PPTs of types of Headlamp, Tail lamp, Indicator and Fuel tank shape. Actual Components may be shown.	CONCEPT	Ground Clearance, Safety	Explain the importance of ground clearance as applied to road conditions with pothole and Bumps, using chalk & board or PPTs. Explain the concept of safety of rider and pillion rider in relation to drive gear, driving habits and guards.	PRINCIPLE	Aerodynamic and Ergonomic Principles	Explain the Aerodynamic and Ergonomic Principles applied to the seat, handle bar, foot rest and shape of fuel tank.	PROCEDURE	--	--	APPLICATION	Aesthetically, ergonomically and aerodynamically designed two wheeler	Explain a two wheeler features as regards aesthetics, ergonomics and aerodynamics using PPTs or Videos. Use of schematic diagram / Exploded views from the workshop manual may be done for better understanding of students.
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	www.youtube.com www.npkauto.com and Websites of Various Two wheeler manufacturer.
Lecture No.	Topic/ Subtopic to be covered
1	6.1 Aerodynamic Aspects • Head lamp shape (Sealed beam and conventional).
2	• Tail lamp and indicator light arrangements- body enclosed and separate.
3	• Shape of Fuel Tank in Motorcycles
4	6.2 Ergonomic and Aesthetic Aspects • Seat Arrangement for rider and pillion rider • Handle bar position.
5	• Floor/ Foot rest for driver and pillion rider,
6	Aesthetic Aspects • Headlamp fairing of motorcycles. • Side panels for scooter/ scooterate and motorcycle.
7	• Ground clearance. • Mud guard shape and position.
8	6.4 Safety Aspects • Crash bar, Saree guard • Driving Habits.
9 & 10	• Drive gear – Jacket, Helmet, Day night goggle.

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:

Strategy for conduction of Experiment No. 04

Instruction to Teacher

1. Teacher should explain the layout of ignition system.
2. He should ask the students to take certain precaution as regards the
 - a. High voltage circuit
 - b. Preventing admission of dirt in the engine cylinder.
 - c. Keeping hands off the rotating parts, even it appears to be stationary.
 - d. Spraying of engine oil out of the timing check opening of the crankcase in case of some motorcycle.
3. Teacher shall explain the procedure of checking ignition timing using timing light. He should draw schematic diagram on board and explain it.
4. We should ask students to perform certain tasks like making the removing plug and covering the spark plug well etc., making electrical connection and holding timing light and aiming it at proper place and note the observation.

Title : Check the Ignition Timing of a two-wheeler and compare it with the Workshop/ Operators Manual Specification. Remove, observe, clean the Spark plug and adjust the gap and refit.

Prior concept: Persistence of vision, TDC mark on the crankshaft pulley.

New Concept: Ignition Timing

Instructions to be given to students

Precautions

- i. While handling spark plug, spark plug cap and its chord ensure that the engine is in the off condition and allowed to cool.
- ii. Clean the cylinder head area around the spark plug. While removing it, unscrew by $\frac{3}{4}$ turn. Crank the engine to blow dirt across threads. (with ignition switch in off condition)
- iii. Using a spark plug spanner, remove the spark plug, cover the spark plug hole by a clean cloth. Observe it for the condition of electrodes, insulation and deposits. Clean it in the spark plug cleaning and testing machine. Check the gap using a wire gauge and adjust if necessary.
- iv. Refit the spark plug. Ensure that appropriate torque is applied while fitting it.
- v. Refit the spark plug cap and chord.
- vi. Connect the timing device to the ignition system and start the engine.
- vii. Caution: Ask students to keep their hands and tools off the rotating parts. The magneto appears to be stationary due to persistence of vision.
- viii. Crank the engine with ignition switch in ON condition. Aim the timing gun flashes at the reference mark and timing marks of the engine.

- ix. Observe the ignition timing during idling and at particular engine rpm as per manufacturer's specification. As the throttle is opened, ignition timing gets changed and the timing mark appears to move in advanced direction. (Opposite to direction of rotation)
- x. Compare the result with specification of the engine.
- xi. Apron, belt and shoes should be made compulsory for the practical.

Questions

- 1. Describe the concept of persistence of vision.
- 2. Describe significance of correct ignition timing.
- 3. State the necessity of ignition advance.
- 4. List tools and equipment used in conduct of experiment.

In the similar way strategy for other practical's may be prepared.

5.4.1 Suggestions for effective conduct of practical and assessment:

5.4.3 Preparation for conduct of practical

6. Mode of assessment:

6.1.1 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.										
-----------------	--	--	--	--	--	--	--	--	--	--

17521

Institute Name:

Course Name: Automobile Engineering

Course Code: AE 5G

Semester: FIFTH

Title of the Subject: Two Wheeler Technology

Subject Code: 17521

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

Q.1) ATTEMPT ANY THREE

09

MARKS

- a) State three features of a two wheeler gearbox.
- b) How Multi-port arrangement in Two-Stroke engine is useful?
- c) Draw a schematic diagram of fuel valve of vacuum operated fuel supply system.
- d) State 2 types of muffler. State application of any one type.

Q.2) ATTEMPT ANY TWO

08

MARKS

- a) Describe the operation of normal running circuit in a carburetor. Draw a schematic diagram for the same.
- b) State 2 merits of chain drive and 2 merits of gear drive types of transmission mechanism.
- c) State the gear ratios used in a scooter. Why neutral position of gear shifter appears between 1st and 2nd gear position?

Q.3) ATTEMPT ANY TWO

08

MARKS

- a) Describe concept of Wet Sump Pressurized lubrication for two-Stroke engine.
- b) Describe the working of Exhaust Gas Recirculation System using a Block diagram.
- c) Draw a schematic diagram of single cradle frame and label it.

Sample Test Paper II

Roll No.

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17521

Institute Name:

Course Name: Automobile Engineering

Course Code: AE 5G

Semester: FIFTH

Title of the Subject: Two Wheeler Technology

Subject Code: 17521

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

Q.1) ATTEMPT ANY THREE

09

MARKS

- a) State three advantages of gas filled shock absorber for rear end suspension.
- b) State three benefits of twin spark ignition system.
- c) Write the criteria of selection of wheel for
 - i) Motorcycle
 - ii) Scooter
 - iii) Sports bike
- d) State the use of Speedometer, Trip meter and Tachometer in dash Board.

Q.2) ATTEMPT ANY TWO

08

MARKS

- a) Describe working of Double acting type of Shock Absorber.
- b) Describe the Handle bar Arrangement in two wheeler.
- c) Draw a schematic sketch for Lever Operated brake system.

Q.3) ATTEMPT ANY TWO

08

MARKS

- a) Draw a schematic diagram of kick-start arrangement.
- b) State use of

- i) Reflector
- ii) Tail Lamp
- ii) Number Plate lamp
- iv) Side stand indicator lamp
- c) Describe the working of Condenser Discharge Ignition system with neat Sketch.

6.2 End of Semester Theory Paper

6.2.1 Characteristics of a Good Examination Question Paper

6.2.1.1 Introduction

While a student answers a question, he refers to his Long Term Memory (LTM) and sees if the answer could be readily available from the memorised data. If this is not possible, the student processes information from his LTM and then provides the answer. All these activities are related to processes taking place in the brain. Through question paper, we are trying to measure intellectual activities which may not have precise measurement. The question paper which we use to measure learning of a certain topic is usually called an instrument or a tool. The question paper or the instrument we are designing to measure achievement in a given subject/content should have certain qualities which will ensure a fair degree of confidence on the results of the examination.

Standard of any examination depends upon quality of question paper and therefore efforts must be made to see that question paper is set on scientific principles. A question paper can be called a good quality question paper if it possesses the following essential characteristics.

- Validity
- Reliability
- Objectivity
- Usability

6.2.1.2 Validity

Validity refers to the extent to which it measures what it intends to measure. If we design a test or a question paper to measure what students have learnt in a subject, say “Applied Mechanics”, it should measure their achievement in Applied Mechanics only, nothing else; and the scores in this subject are not distorted by irrelevant factors. Basically, the, validity is always

concerned with the specific use of the test results and the soundness of our proposed interpretations.

There are different types of validities of a test/question paper. In our examination question paper it is adequate and appropriate to consider only one type of validity i.e. content validity. The content validity is related to the extent to which the question paper conforms to the curriculum content and the pre-determined objectives. This validity is ensured by designing question paper that matches with the specification table, which contains content matter to be tested and the cognitive levels at which this content is to be tested.

6.2.1.3 Reliability

Reliability refers to the consistency of measurement i.e. the consistency with which an examination question paper measures whatever it measures. If a teacher gives today an achievement test in a subject to his students, how similar would have been the student's scores had this test been given yesterday or tomorrow? How would the scores have varied had the teacher selected a different sample of equivalent questions? If it were a question paper containing essay type question, how would the scores have differed had a different teacher scored / evaluated it? These are the types of questions with which reliability is concerned. Unless the measurement can be shown to be reasonably consistent over different occasions or over different samples of the same performance domain, we can have little confidence in the results.

While measuring length, can any one get consistent results while using a tape made of elastic material? Depending upon how much the tape is stretched; different lengths would be obtained on each occasion. Reliability estimates of a question paper refer to the results of measurement. A reliable (consistent) measure is not necessarily valid. Reliability is strictly a statistical concept.

Reliability or the amount of faith which can be placed on the scores/marks of a question paper depends upon a number of factors. Some of these factors are –

i) **Clarity, Definiteness and Objectivity of the question paper**

Question paper which permits students to make widely divergent interpretations of what is expected of them (in their answer) is not likely to yield highly reliable results. For example, teacher assessing the answer books may have different expectations from students, if the questions are not specific, and are worded vaguely.

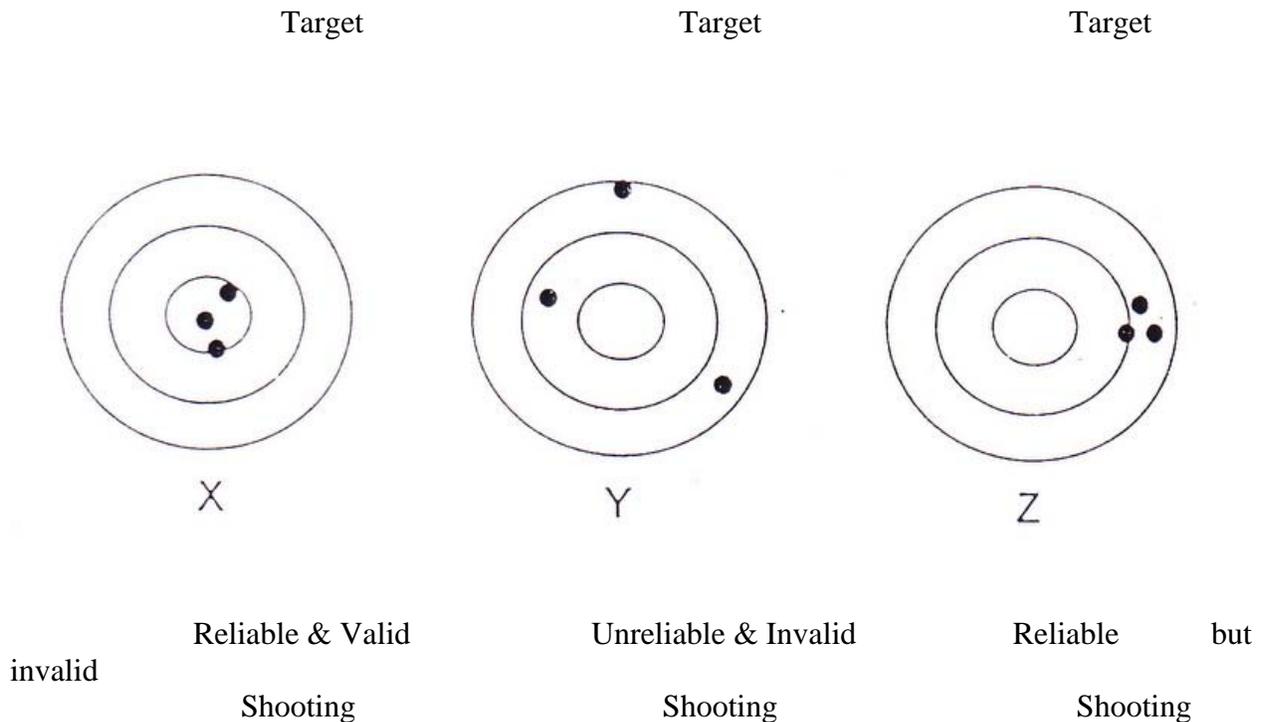
ii) **Examiners Objectivity**

This relates to consistency with which examiners examine and mark the answer scripts/books. If marks assigned to answers are greatly influenced by the examiner’s state of mind at that moment, no one will keep faith in the assigned marks, and reliability of marking is adversely affected.

iii) **Number of Questions**

Researchers have shown that more number of questions in a question paper lead to more reliability. Reliability also depends upon the spread of scores, difficulty level of the question paper and objectivity of scoring.

The relation between validity and reliability is sometimes confusing to persons who come across these terms for the first time. Reliability (consistency) of measurement is needed to obtain valid results but we can have reliability without validity. The target shooting illustration, in the figure below, shows the concept that “reliability is a necessary but not a sufficient condition for validity”



Three shooters X, Y, Z shoot at the target, each getting three shots. Shooter Y Shoots at different places far away from the bull's eye. Z consistently shoots at the border spot. X consistently shoots close to the bull's eye.

6.2.1.4 Objectivity

This concept is related to marking of answer scripts. When answer scripts are assessed and marked in such a way that the total score obtained by students to not change appreciably, we say that the marking is objective. As against this, if extraneous personal biases and preferences of examiners influence marking of answer scripts, the assessment is subjective in nature. Thus objectivity implies assessment free from all extraneous factors and is opposite to subjectivity.

The element of subjectivity can be substantially reduced and objectivity improved, if the following steps are taken.

1. Designing an assessment scheme for a course.
2. Developing specification table for question paper indicating distribution of marks for different topics and levels.
3. Preparing a format of question paper showing distribution of topics in different questions, and indicating types of questions for abilities to be tested.
4. Designing question paper as per specification table.
5. Editing the question paper so that it meets all the criteria and conform to the specification table.
6. Developing scheme of marking for the answers to supply type questions (i.e. questions which make students to provide answers in sentence/figural/graphical form). This is the most necessary requirement for reducing subjectivity.

6.2.1.5 Usability or Practicability

An examination system should be so designed that it is possible to implement it without much problems or difficulties. The system should not be something that looks good or ideal on paper but can't be implemented. In addition to providing examination results that possess a satisfactory degree of reliability and validity, an examination system should also satisfy certain other practical requirements, given below.

- i) The system is economical from the point of view of both money and time.
- ii) It should be easy for administration and marking.

- iii) The system should be simple enough to be properly understood by all the concerned persons.

6.2.1.6 How to Ensure Reasonable Validity?

In order to have a valid test or an evaluation procedure, we must ensure that it is relevant to the purpose for which it is to be used; it means that there should be a close relationship between validity of a question paper and objectives of the test. In simpler words, by test validity we mean the accuracy, conformity and effectiveness with which the test measures what it intends to measure (Objectives).

The following steps can help to ensure reasonable degree of validity:

- a) Specify the purpose of assessment.
- b) Clearly define the objectives.
- c) Divide the course content into convenient chapters.
- d) Provide proportional weightage to each chapter.
- e) Provide proportional weightage to different objectives and their levels.
- f) Develop question on each of the sampled cognitive process dimension in each unit in accordance with the weightage assigned.
- g) Avoid providing free option like ‘attempt any 6 out of 9’. However, internal option of “either”, “or” type can be given with proper care of content and objectives.

It can be noticed that the only assurance we have that a test is a *valid* measure of the intended learning outcomes, is to use a systematic procedure for obtaining a representative sample of the curriculum in the question paper. The table of specifications is a device which provides the procedure for obtaining a representative sample of curriculum in the question paper and thus ensures content validity.

6.2.2. Approach for Designing Good Question Paper

6.2.2.1 Concept of Specification Table

A table of specification is a blue print for test or question paper design. Just as an engineer prepares a blue print before constructing a structure, a specification table is prepared in advance of the examination, so that a valid test could be designed.

In fact, a Table of Specifications is a sampling plan of the objectives to be tested in the test. This ensures following things:

- All important topics of the subject matter are adequately represented.
- There is no undue weightage given to any particular topic/topics.
- No content area worthwhile for testing is omitted from the test.
- The test samples adequate proportion of abilities at different taxonomy levels, in each part.

6.2.2.2 Guidelines for Preparing Specification Table

1. Study the two dimensional table of objectives
2. Use the weightages of marks (out of 80) for each chapter/topic in the subject
3. In assigning relative weightages to each topic and level of learning outcomes, a number of factors have been considered. These factors are:
 - How important is each topic in relation with total learning experience?
 - How much time is expected to be devoted to each topic during instructions?
 - What relative importance does curriculum assign to each topic?
 - At what levels is the topic taught?
 - What amount of emphasis is given for each topic at what levels?

Specification table should consider the following:

- Content to be observed
 - Objectives to be achieved
 - Levels of objectives
 - Total time and marks for the paper
1. The specification table consists of chapters/topics and levels of cognitive process dimension like R, U, A.

These cognitive process dimensions are –

R = Remember

U = Understand

A = Analyse / Apply

5. Review the chapter/topic and think about probable distribution of marks at the three levels (R, U, A,) for assessment. Normally distribution be done in multiples of two marks. Enter marks for each topic under the levels R, U, A.
6. Make total of vertical columns R, U, A. Suggested distribution is R=10% to 30%, U=40% to 55% and A=30% to 45% depending upon the level of the students.
A Sample Classification Table is given below with arbitrary marks.

Exam Seat No.									
----------------------	--	--	--	--	--	--	--	--	--

17521

Maharashtra State Board of Technical Education
Sample Question Paper

Course Name: Automobile Engineering

Course Code: AE 5G

Semester: FIFTH

Title of the Subject: Two Wheeler Technology

Subject Code: 17521

Marks: 100

Times: 3 Hours.

Q. 1 A) ATTEMPT ANY THREE

12 MARKS

- a) State two types of frame. Describe construction of any one type.
- b) Draw a schematic diagram of air cleaner and label it.
- c) Why a decompression valve is used in some engines? Draw a schematic diagram for the same.
- d) Compare Overhead Valve and Overhead Cam arrangements on the basis of
 - i) Engine height
 - ii) Valve timing
 - iii) Cam shaft location
 - iv) Maintenance

B) ATTEMPT ANY ONE

06 MARKS

- a) Draw and describe layout of gravity feed type of fuel supply system.
- b) Describe operation of Microprocessor Controlled Ignition System using block diagram.

Q. 2 ATTEMPT ANY FOUR

16 MARKS

- a) Describe two features of Monocoque construction.
- b) State Four advantages of using multiple valves.
- c) Demonstrate the importance of raised seat for pillion rider using a schematic diagram.
- d) State four advantages of Monoshock suspension system.
- e) Identify the system using the components shown in figure. List the components as numbered in the figure. (6 Components)

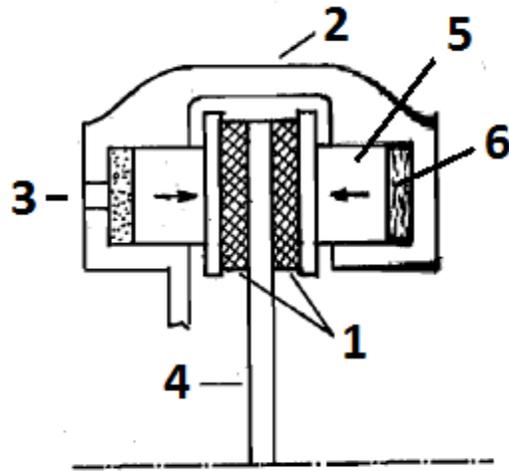


Fig.

Q. 3 ATTEMPT ANY FOUR

16 MARKS

- a) Draw a labeled sketch of Variator mechanism used in belt drive.
- b) Distinguish between the carbureted fuel supply and Electronic Fuel Injection system on the basis of
 - i) Drivability
 - ii) Emission
 - iii) Efficiency
 - iv) Maintenance
- c) Explain the purpose of providing caster angle with the schematic diagram for a motorcycle.
- d)
 - i) How does variable rate coil spring affect suspension system?
 - ii) Why coil-in-coil spring arrangement is used in suspension.
- e) Draw layout of hydraulic braking system used in a motorcycle and label it.

Q. 4 A) ATTEMPT ANY THREE

16 MARKS

- a) Differentiate between wheels of motorcycle and scooter on the basis of
 - i) Size
 - ii) Construction
 - iii) Tyre Rotation
 - iv) Off road driving suitability

- b) State the purpose of using following
 - i) LED light in tail lamp
 - ii) Neutral Indicator Lamp
 - iii) High Beam Indicator lamp
 - iv) Tachometer at the dashboard
- c) Draw a schematic diagram showing AC and DC circuits of a two wheeler and label it.
- d) Describe working of Condenser Discharge ignition system and state two advantages of the same.

B) ATTEMPT ANY ONE

06 MARKS

- a) Draw a schematic diagram of starting circuit of a two wheeler **carburetor** and describe its operation.
- b) Describe the function of Following components of Starting system
 - i) DC Motor
 - ii) Battery
 - iii) Solenoid

Q. 5 ATTEMPT ANY FOUR

16 MARKS

- a) Compare chain drive and belt drive type of transmission systems on the basis of
 - i) Efficiency
 - ii) Construction
 - iii) Service life
 - iv) Maintenance
- b) Why modern scooterate exhaust tail pipe is raised?
- c) Draw a schematic diagram of charging system of a two wheeler
- d) State the importance of
 - i) Foot rest for pillion rider during braking
 - ii) Mud- guard shape for motor cycle rear wheel.
- e) State the use of following
 - i) Crash bar
 - ii) Saree guard
 - iii) Jacket (Drive Gear)

iv) Helmet

Q. 6 ATTEMPT ANY FOUR

16 MARKS

- a) State the use of
 - i) Speedometer
 - ii) Trip Meter
 - iii) Reflector
 - iv) Tail Lamp
- b) Why a separate oil pump is used in modern two-stroke engine lubrication? State one application.
- c) Statements: Kick start method is used for cold engine. Button start method is preferred for hot engine. Justify the statements.
- d) Describe the purpose of providing
 - i) A particular shape to motorcycle fuel tank
 - ii) Ground clearance
- e) Describe the ergonomic aspects for
 - i) Motorcycle Handle bar
 - ii) Driver's Seat (Motorcycle).

SAMPLE BASIS OF MARKING

Que No.	Sub Que No.	Basis of Marking	Mark Allotted	Remarks														
1A	a	Two types of frame (1 Mark) Describe any one type of frame (3 Marks)	4															
	b	Schematic diagram of air cleaner (3 Marks) Labels (1Mark)	4															
	c	Reason of using decompression valve in some engines (2 Marks) Schematic diagram of Decompression valve (2 Marks)	4															
	d	Comparison of Overhead Valve and Overhead Cam arrangements on the basis of i) Engine height (1 Mark) ii) Valve timing (1 Mark) iii) Cam shaft location (1 Mark) iv) Maintenance (1 Mark)	4															
		<table border="1"> <thead> <tr> <th>Parameter</th> <th>Overhead Valve arrangement</th> <th>Overhead Cam arrangements</th> </tr> </thead> <tbody> <tr> <td>Engine height</td> <td>Less than OHC</td> <td>More</td> </tr> <tr> <td>Valve timing</td> <td>Moderate accuracy due to inertia of valve gear train</td> <td>Accurate, few components of valve gear, so lesser inertia</td> </tr> <tr> <td>Cam shaft location</td> <td>Crankcase</td> <td>Over the Cylinder head</td> </tr> <tr> <td>Maintenance</td> <td>More-due to no of moving</td> <td>Less maintenance</td> </tr> </tbody> </table>			Parameter	Overhead Valve arrangement	Overhead Cam arrangements	Engine height	Less than OHC	More	Valve timing	Moderate accuracy due to inertia of valve gear train	Accurate, few components of valve gear, so lesser inertia	Cam shaft location	Crankcase	Over the Cylinder head	Maintenance	More-due to no of moving
Parameter	Overhead Valve arrangement	Overhead Cam arrangements																
Engine height	Less than OHC	More																
Valve timing	Moderate accuracy due to inertia of valve gear train	Accurate, few components of valve gear, so lesser inertia																
Cam shaft location	Crankcase	Over the Cylinder head																
Maintenance	More-due to no of moving	Less maintenance																

			components	due to lesser moving part.		
1B	a	Diagram of layout of gravity feed type of fuel supply system. Description	(3 Marks) (3 Marks)		6	
	b	Block Diagram of Microprocessor Controlled Ignition Operation	(3 Marks) (3 Marks)		6	
2	a	Two features of Monocoque construction with description	(2 Marks Each)		4	
	b	Four advantages of using multiple valves	(1 Mark each)		4	
	c	Importance of raised seat for pillion rider Schematic diagram	(2 Marks) (2 Marks)		4	
	d	Four advantages of Monoshock suspension system	(1 Mark each)		4	
	e	Identify and name the sub-assembly List six Component as Numbered Each)	(1 Mark) (1/2 Mark)		4	
3	a	Sketch of Variator mechanism used in belt drive. Labels	(3 Marks) (1 Mark)		4	
	b	Distinguish between the carbureted fuel supply and Electronic Fuel Injection system on the basis of 1. Drivability 2. Emission 3. Efficiency 4. Maintenance	(1 Mark each)		4	

	c	Purpose of providing caster angle (2 Marks) Schematic diagram for a motorcycle (2 Marks)	4	
	d	Effect of variable rate coil spring on suspension system (2 Marks) Use of coil-in-coil spring arrangement in suspension. (2 Marks)	4	
	e	Layout of hydraulic braking system (2 Marks) Label 4 Component (1/2 Mark Each)	4	
4A	a	Differentiate between wheels of motorcycle and scooter on the basis of i) Size ii) Construction iii) Tyre Rotation iv) Off road driving suitability (1 Mark each)	4	
	b	Purpose of using following i) LED light in tail lamp (1 Mark) ii) Neutral Indicator Lamp (1 Mark) iii) High Beam Indicator lamp (1 Mark) iv) Tachometer at the dashboard (1 Mark)	4	
	c	Schematic diagram showing AC and DC circuits of a two wheeler (3 Marks) Labels (1 Mark)	4	
	d	Working of Condenser Discharge ignition system (3 Marks) Two advantages (1/2 Mark each)	4	
4B	a	Schematic diagram of starting circuit of a two wheeler carburetor (3 Marks) Description of its operation. (3 Marks)	6	
	b	Function of components of Starting system i) DC Motor (2 Marks)	6	

		ii) Battery (2 Marks) iii) Solenoid (2 Marks)		
5	a	Comparison of chain drive and belt drive type of transmission systems on the basis of i) Efficiency ii) Construction iii) Service life iv) Maintenance (1 Mark each)	4	
	b	Reason for raising exhaust tail pipe of modern scooterate (4 Points; 1 Mark each)	4	
	c	Schematic diagram of charging system of a two wheeler (3 Marks) Labels (1 Mark)	4	
	d	Importance of i) Foot rest for pillion rider during braking (2 points, 1 mark each) ii) Mud- guard shape for motor cycle rear wheel. (2 points, 1 Mark each)	4	
	e	One use of Each i) Crash bar ii) Saree guard iii) Jacket (Drive Gear) iv) Helmet (1 Mark each)	4	
6	a	Use: i) Speedometer ii) Trip Meter iii) Reflector iv) Tail Lamp (1 Mark – 1 use each)	4	
	b	Three reasons for using separate oil pump in modern two-stroke engine lubrication (1 Mark	4	

	each) One application (1 Mark)		
c	Justification of statements (2 Marks each)	4	
d	Description of purpose i) A particular shape to motorcycle fuel tank (2 Marks) ii) Ground clearance (2 Marks)	4	
e	Description of the ergonomic aspects for i) Motorcycle Handle bar (2 Marks) ii) Driver's Seat (Motorcycle) (2 Marks)	4	