CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

Automobile Engineering And Manufacturing -17614

SIXTH SEMESTER PRODUCTION ENGINEERING /TECHNOLOGY GROUP

DECEMBER 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.

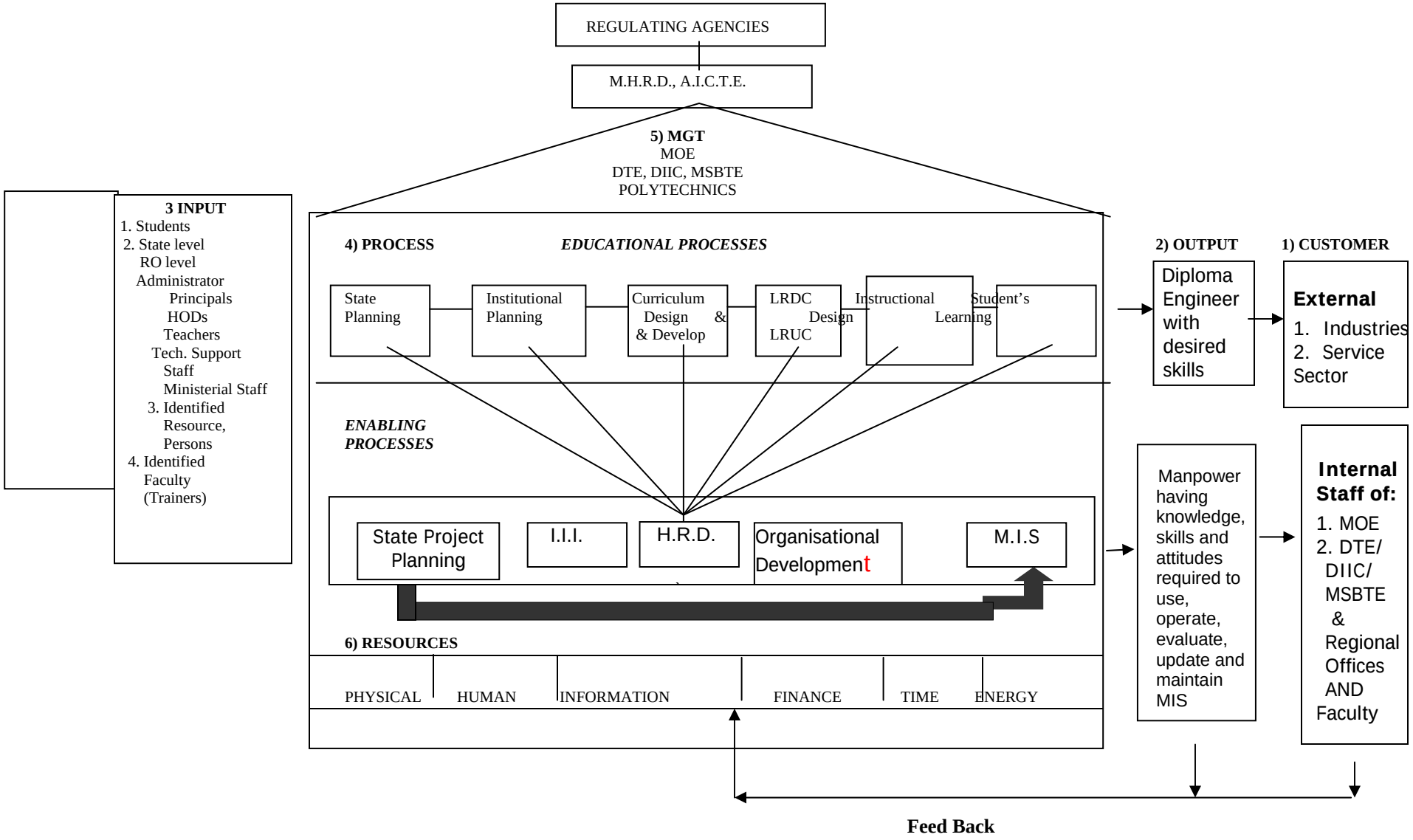

Fig 1 Systems Approach

1.4 Curriculum goals

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

1.5 DESIRED SKILLS

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

Life Skills:

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

Technological Skills:

Diploma engineers should possess following intellectual and motor skills in order to satisfactorily perform duties assigned to them:

A) Intellectual skills.

1. Reading and interpretation of production drawings
2. Planning for materials, tools, processes and quality control techniques.
3. Use of Operation and Maintenance Manuals
4. Operation of new equipment, machinery and instruments like CNC, PLC, controllers, Robotics, EDM, ECM, laser cutting/welding, etc
5. Use of CAD for 2D drawings and familiarity with CAD software like Idea, Catia, Pro-E etc (Awareness level)
6. 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.
7. Design of Machine Element
8. Problem solving skills
9. Cost Reduction techniques
10. Use of standards (ISO-9000, QS14000, etc)

B) Motor Skills.

1. Maintenance of modern equipments and machineries
2. Develop drafting Skills
3. Operate Lathes, Drilling Machines, CNC Machines, Milling and Shaping Machines, Grinding Machines,
4. Test Machine Performance
5. Setting up of Automatic machines
6. Carry out In process gauging

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1.6 Salient Changes in the curriculum:

- For First Semester Basic Science is divided into two parts- Basic Physics and Basic Chemistry. Theory examination of both parts as well as practical examination of both parts will be conducted on separate days. Sum of theory marks of both parts shall be considered for passing theory examination of Basic Science. Similarly it is applicable to practical examination. It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- For second semester Applied Science is divided into two sections- Applied Physics and Applied Chemistry where the theory examination of 50 marks each and practical examination of 25 Marks each will be conducted separately and the minimum passing marks for Applied Science will be the combination of both the sections. . It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- The components of Development of Life Skills were taught in two semesters. In Development of Life Skills –I the topics related to personal development, such as Learning to Learn Skills, personality development, presentation skills etc. were included. In Development of Life Skills – II the topics related to Team Building, Leadership, group behavior etc. were covered. In the revised curriculum the scope of development of life skills has been broaden to include behavioral science component. Therefore the subject Development of Life Skills – II has been renamed and it is now included at Vth Semester in the revised curriculum under the title Behavioral Science.
- The subject of Professional Practices was introduced to integrate the skills acquired in Development of Life Skills, through technical subjects from second to sixth semester. The experience in implementing the contents of the subject shows that there are limited activities possible in second semester as the technical knowledge given to the students is very limited. Also at sixth semester the student are doing projects in which they are performing many activities included in the Professional Practices and therefore it is proposed that the subject of Professional Practices be prescribed only for three semesters vis. Third, fourth and fifth semesters.
- Introduction of Environment Studies at fourth Semester for all courses

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

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.

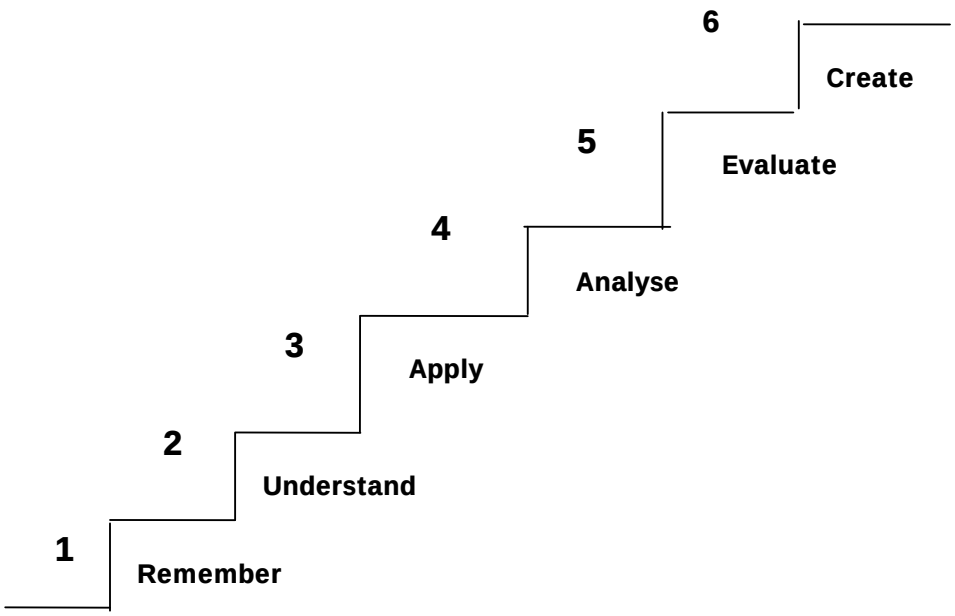
2.3 LEVELS OF LEARNING:

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 ad other is knowledge dimension. Details of these two dimensions are given below.

2.4.1 Cognitive Domain:

Dr. Benjamin Bloom (1956) analysed questions asked in various examinations in American situation and proposed a hierarchical arrangement of instructional objectives (Intellectual abilities) tested by these questions.

The lowest level of cognitive learning achieved by a student is demonstrated by the recall of information that the student retrieves from his long term memory. So, the storage and retrieval of specific facts, concepts, principles, laws, definitions, properties, procedures etc. directly from memory was classified as a knowledge level objective. Thus questions testing memory of students were treated as at the lowest level of the hierarchy of intellectual abilities. The other levels of hierarchy proposed by Dr. Bloom in 1956 relate to the degree of information processing required in the brain needed to provide answer to a question. The various levels in the cognitive hierarchy proposed by Dr. Bloom in 1956 and further revised in 2001 are given below in the diagrammatic form.



Following are the details of each level which indicate the general and specific objectives. Further appropriate verbs are given which are useful in setting good questions. In this table only four levels are considered for diploma students.

Description of the Major Levels in the cognitive Domain (Bloom's Taxonomy)	Illustrative General Instructional Objectives	Illustrative verbs for stating specific learning outcomes
Remember – Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required	Knows common terms, specific facts, basic concepts, principles, methods & procedures	Define, describe, identify label, list, match, name, outline, reproduce, select,

to mind of the appropriate information. This represents the lowest level of learning outcomes in the cognitive domain		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 studing 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 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 others words, relationship between two or more concepts which is scientific and universally true is called a Principle.

For Example: (related concepts are underlined)

1. Actions and reactions are equal and opposite.
2. Ohm's law I = V/R is a principle, where I (Current), V (Voltage), and R (Resistance) are the concepts. While teaching a principle we must recall the concepts which it involves. These concepts might have been taught in the previous lesson. As you already know, concept learning is a prerequisite to Principle learning. Thus we recall the concepts of current,

voltage and resistance by asking questions to the students. Only after that we must tell the relationship among these i.e. Ohm's Law.

3.1.5 APPLICATIONS:

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

For example:

1. Ohm's law can be applied to find out the unknown quantity (voltage, current, and resistance).

2. Design of a structure can be made based on related principles and theories.

3. Principles of learning and events of instruction can be applied in ‘Designing a lesson Plan' and 'Presenting the lesson in the classroom".

4, The above principles can also be applied while preparing textbooks, workbooks, learning packages and laboratory manuals to be used by the students.

3.1.6 PROCEDURES:

While 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 Production Technology / Diploma in Production Engineering

Course code : PG / PT

Semester : Sixth

Subject Title : Automobile Engineering and Manufacturing

Subject Code : 17614

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	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:

Automobile manufacturing system is an applied technology. This course in production engineering will allow students to apply their knowledge about various Automobile manufacturing systems, sub systems and their relationship with sense of manufacturing technology.

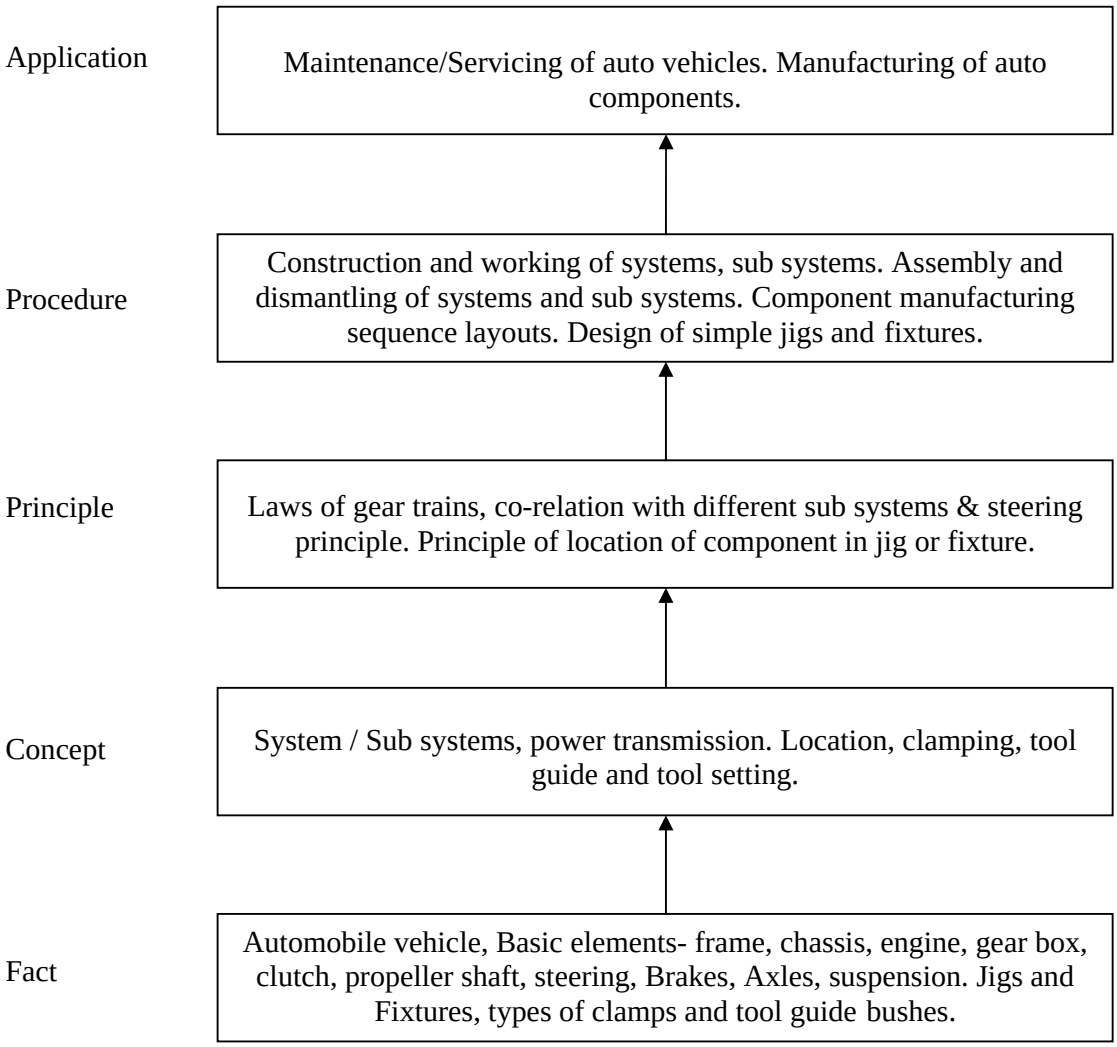
In the era of globalization, all the major global players in the automobile manufacturing sector have launched their plants in India. To meet their demand of skilled man power the diploma holders plays a vital role.

Objectives:

The student will be able to

1. Understand working of various automotive systems & sub systems.
2. Understand various manufacturing processes for automobile components.
3. Prepare process plan and specify tooling for manufacturing of simple components.
4. Design simple Jigs and Fixtures.

Learning Structure:



Theory:

Topic and Content	Hrs.	Marks
1. Introduction to automobile **Specific Objective:** ➢ Classify automobile vehicles. ➢ State functions of given automobile component. **Content:** 1.1 Classification of automobiles vehicle, layouts of automobile vehicles with components and their functions. **04 Marks** 1.2 Types of chassis, construction of body, body nomenclature, body shop painting, and introduction to aerodynamic body shapes. **04 Marks**	05	08
2. Automobile transmission **Specific Objective:** ➢ Describe components of automobile transmission system. ➢ Describe working of propeller shaft. **Content:** 2.1 Clutch - Necessity, construction and working of coil Spring & diaphragm spring type clutch**.** **06 Marks** 2.2 Gear Box- Types, construction and working of constant mesh, synchromesh, epicyclic gear box, overdrive, double declutching**.** **06 Marks** 2.3 Final Drive – Necessity, construction and working of Propeller shaft and differential**.** **04 Marks** 2.4 Types of rear axle and front axle with their functions and applications. **04 Marks**	12	20
3. Control systems **Specific Objective:** ➢ State working principle of power steering. ➢ Describe construction and working of hydraulic brake. **Content:** 3.1 Steering systems: necessity, Constructions & working of steering linkages. Types of steering gear box, rack &pinion steering gear, re-circulating ball bearing with Construction and working. working principle of power steering, steering geometry, Camber, Caster, Toe-in, Toe-out, King pin inclination & their effects**.** **08 Mark** 3.2 Brake Systems: necessity, Types, Construction & Working of hydraulic brake, pneumatic brake, drum brake and disc brake with their advantages and disadvantages**.** **08 Marks**	10	16
4. Suspension system **Specific Objective:** ➢ Classify suspension systems ➢ Describe construction of telescopic shock absorber. **Content :** 4.1 Necessity, Classification**,** construction and working of rigid axle, independent suspension system. **08 Marks** 4.2 Construction & working of McPherson, wishbone &Trailing link suspensions. **04 Marks** 4.3 Construction & working of telescopic shock Absorbers. **04 Marks**	09	16
5. Manufacturing Major Automobile Components **Specific Objective:** ➢ Describe manufacturing processes of crank shaft. **Content:**	14	20

5.1 Car body manufacturing- Sheet metal cutting, forming, welding, joining, painting and finishing. **04 Marks** 5.2 Cylinder block- Casting, machining and finishing, Piston- die casting, Heat treatment & machining, Liners- casting, Heat treatment & machining. **04 Marks** 5.3 Connecting Rod: Forging, machining, heat treatment, Broaching **04 Marks** 5.4 Crank shaft- Forging, machining, heat treatment, grinding, lapping& dynamic balancing. **04 Marks** 5.5 Leaf Spring- cutting, drilling, hardening, tempering, bending, pre-stressing & protective coating, Final assembly and painting. **04 Marks**		
6. Process planning and Jig/Fixture Design **Specific Objective:** ➢ Design of Jig for an automobile component. ➢ Design of Fixture for an automobile component. **Content:** 6.1 **Introduction** **04 Marks** Principles of Jig and fixture design, Locating devices, types of locators for different types of surfaces and shapes, design considerations for jig and fixture design and steps to be followed. 6.2 **Design of Drilling Jig** – features and applications of different types of drilling jigs- plate jig, angle plate jig, box jig, tumble jig, universal jig. Design process for a simple jig. **08 Marks** 6.3 **Design of Milling Fixture** – essentials of milling fixtures - Tennon pins, setting block, types of fixtures, special clamping devices. Design process for a simple fixture. **08 Marks**	14	20
Total	**48**	**100**

Practical:
Skills to be developed..
Intellectual skills

1) Follow sequence of dismantling and assembling.

2) Use of service manual for information search.

Motor Skills

1) Use of instruments for dismantling and assembling.

2) Carry out maintenance as per users manual.

List of Practical:

1) Carry out automobile engine maintenance of four wheeler or two wheeler as per manufacturer's specifications.

2) Demonstration on working of single plate coil spring or diaphragm spring clutch. Sketch and describe its construction.

3) Demonstration on differential gear box. Sketch and describe its construction.

4) Demonstration of rack and pinion steering gearbox. Sketch and describe its construction.

5) Write a report on visit to an Automobile Manufacturing / Ancillary industry or service centre and write report on rigid axle, hydraulic and pneumatic braking system

6) Prepare a process plan for a simple automobile component.

7) Design of Jig for a simple automobile component.

8) Design of Fixture for a simple automobile component.

Learning Resources:
Books:

Sr. No.	Title	Author	Publication
1	Automobile Engineering	Kirpal Sing	Standard Publication
2	Automobile Engineering	G.B.S. Narang	Khanna Publishers Delhi
3	Automotive Mechanics	Willian Crouse, D. L. Anglin	Tata McGraw Hill
4	Automotive Technology	H.M. Sethi	Tata McGraw Hill
5	Automotive Engines	James D.Halderman Chase D.Mitchell	Pearson Education
6	Jigs & Fixtures	P. H. Joshi	Tata McGraw Hill
7	Production Engineering	P.C. Sharma	S. Chand Publications
8	Industrial Engineering and Management	O.P. Khanna	Dhanpat Rai & Sons
9	Production Technology	R K Jain S C Gupta	Khanna Publishers, Delhi

4.1 Sample Lesson Plan:

- Irrespective of teaching experience every teacher must plan each and every lecture to be delivered by him / her.
- The lesson planning may be noted on the paper or in case of senior teachers it may be planned in the mind.
- Sample format of lesson planning is given below:

Sr. No.	Phase	Events	Time to be allotted
1.	Introduction	• Recall of Prerequisites. • Linking of previous knowledge with the new topic. • Creating interest among the students.	5 to 10 Minutes
2.	Development	• Content Delivery (should be such that the interest should be created & sustained among the students) • Giving analogy for the abstract concepts. • Giving examples from the world of work. • Solving numerical problems. • Asking questions to the students. • Involving students in the teaching learning process.	40 to 50 Minutes
3.	Consolidation	• Summarizing the lecture. • Creating curiosity among the students about the next lecture	5 to 10 Minutes

5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

Topic I

Introduction to Automobile

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	**Automobile Vehicle, Chassis**	Show the various components. Make use of PPTs for better understanding of students.
CONCEPT	**Function of Automobile Vehicle**	Explanation with chalk & board initially. Make use of PPTs.
PRINCIPLE	**Force, Center of gravity**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**1. Layout of Automobile vehicle with component and their function. 2.Construction of Vehicle body**	Demonstrate through models/PPT/Actual components.
APPLICATION	**Automobile vehicle its components**	Demonstrate through models/PPT/Actual components.

Learning Resources:

Books: 1) Automobile Engineering –Dr.Kripalsingh –Standard Publishers

2) Automobile Engineering –GBS Narang –Khanna Publishers ,Delh

Teaching Aids: BB,PPT,Model,Chart

PPT with Sample:www.slideshare.net(Search for relevant PPT from Home Page),

Thermodynamic II.pptx

Websites www.slideshare.net

www.howstuffworks.com

www.autoshop101.com

www.educypedia.be

www.youtube.com

Lecture No.	Topic/ Subtopic to be covered
1	Classification of Automobile vehicle.
2	Layout of automobile vehicle with components and their functions
3	Types of chassis, Construction of body
4	Body Nomenclature ,body shop painting,
5	Aerodynamic body shapes

Topic 2 **Automobile Transmission**

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

Knowledge Category	Example/s of category	Teaching methodology
FACT	**Gear Box, Clutch , Propeller shaft**	Show the various types of Gear box, clutch and and propeller shaft its components. Make use of PPTs for better understanding of students.
CONCEPT	**Power Transmission**	Explanation with chalk & board initially. Make use of PPTs. And charts.
PRINCIPLE	**Laws of Gear Train**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**Construction &Working Clutch ,Gearbox and final drive**	Demonstrate through PPT/Actual components.
APPLICATION	**Various types of vehicle**	Demonstrate through PPT/Actual components.

Learning Resources:
Books: 1) Automobile Engines-James D.Halderman
2) Automotive Mechanics –William Crouse

Teaching Aids: Charts, working models

PPT with Sample:www.slideshare.net(Search for relevant PPT from Home Page)

Websites: www.youtube.com (Search for relevant videos from Home Page).
www.Howstuff.com

Lecture No.	Topic/ Subtopic to be covered
1	Components of Automobile Transmission system
2	Necessity ,Construction & working of Clutch
3	Necessity, Construction & working of coil spring.
4	Necessity ,Construction & working of constant Mesh Gearbox
5	Necessity ,Construction & working of Synchromesh Gearbox
6	Necessity ,Construction & working of epicyclic gear train,
7	overdrive ,double declutching
8	Necessity ,Construction & working of propeller shaft
9	Necessity, Construction & working of differential assembly.
10	Types of front & Rear Axles & their functions in brief
11	Application of Rear axles.
12	Revision and discussion on above topic

Topic 3

Control 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 meaningful.

Knowledge Category	Example/s of category	Teaching methodology
FACT	**Steering ,Brakes**	Show the various model and its components. Make use of PPTs for better understanding of students.
CONCEPT	**Steering System, Brake System**	Explanation with chalk & board initially. Make use of model and PPTs.
PRINCIPLE	**Principle of Power steering , Pascal Law**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**Construction & working of Steering linkages, steering gearbox, Brakes and Brake system**	Demonstrate through PPT/Actual components.
APPLICATION	**Various Types Vehicle**	Demonstrate through PPT/Actual components. Videos and animations should be used.

Learning Resources: Servicing of Auto. Vehicles of special system

Books:

Title: 1) Automobile Engineering –Dr.Kripalsingh –Standard Publishers

2) Automobile Engineering –GBS Narang –Khanna Publishers ,Delhi

	Teaching Aids: BB, PPT, Model, Chart **PPTs:** PPTs of Working of Suspension system, www.slideshare.net (Search for relevant PPT from Home Page). **Websites:** http://www.youtube.com (Search for relevant videos from Home Page), www.animatedengines.com www.Howstuffworks.com
Lecture No.	Topic/ Subtopic to be covered
1	Basics concept of steering system , classify steering system.
2	Necessity ,classification, Construction of Power steering
3	Necessity ,classification, Construction of Recirculating type steering system
4	Construction and working Worm & Roller type steering system in brief.
5	Construction and working Brakes system in brief.
6	Construction and working Hydraulic Brake system in brief.
7	Construction and working Pneumatic Brakes.
8	Significance of different type Brake system in brief.
9`	Steering Geometry caster, camber ,toe-in, toe-out
10	Drum brake & disc brake with their advantages & disadvantages.
Topic 4	**Suspension 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 meaningful.**

Knowledge Category	Example/s of category	Teaching methodology
FACT	**Suspension ,Telescopic Shock Absorber**	Show the various model and components. Make use of PPTs for better understanding of students.
CONCEPT	**Suspension**	Explanation with chalk & board initially. Make use of PPTs.
PRINCIPLE	**Pascal Law**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**Construction & working of telescopic shock absorber, rigid axle, McPherson strut, Wishbone & trailing link, Telescopic shock absorber**	Demonstrate through PPT/Actual components and model.
APPLICATION	**2Wheeler, 4Wheeler, Generator**	Demonstrate through PPT/Actual components. Videos and animations should be used.

	Learning Resources: Servicing of Auto. Vehicles of special system **Books:** **Title:** 1) Automobile Engineering –Dr.Kripalsingh –Standard Publishers 2) Automobile Engineering –GBS Narang –Khanna Publishers ,Delhi **Teaching Aids:** BB,PPT,Model,Chart **PPTs:** PPTs of Working of Suspension system, www.slideshare.net (Search for relevant PPT from Home Page). **Websites:** http://www.youtube.com (Search for relevant videos from Home Page), www.animatedengines.com www.Howstuffworks.com
Lecture No.	Topic/ Subtopic to be covered
1	Basics concept of suspension system, classify suspension system.
2	Necessity ,classification, Construction of rigid suspension system
3	Necessity ,classification, Construction of Independent suspension system
4	Construction and working McPherson strut suspension system.
5	Construction and working Wishbone type suspension system.
6	Construction and working trailing link suspension system.
7	Construction and working telescopic type shock absorber.
8	Significance of different type suspension system.
9	Revision of above topic

Topic 5	**Manufacturing Major Automobile Components** **Teacher shall implement the methodology/ techniques mentioned in the following table while teaching the topics. Along with this teacher may use additional/alternative methods to make students learning meaningful.**

Knowledge Category	Example/s of category	Teaching methodology
FACT	**Manufacturing Processes for connecting rod, Crankshaft, leaf spring**	Show the various components. Make use of PPTs for better understanding of students.
CONCEPT	**Manufacturing**	Explanation with chalk

	Processes heat treatment ,composite material	& board initially. Make use of PPTs.
PRINCIPLE	**Balancing**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**Car Manufacturing Processes ,Heat Treatment & Machining**	Demonstrate through PPT/Actual components.
APPLICATION	**Various Types of Vehicle**	Demonstrate through PPT/Actual components. Videos and animations should be used.

Learning Resources:

Books: 1.Automotive Mechanics – William Crouse ,DLAnglin
2.Automotive Technology – H.M.Sethi –Tata McGrawHill
3.Production Engineering – P.C.Sharma –S.Chand Publications

Teaching Aids: BB, PPT, Model, Chart

PPT with Sample:www.slideshare.net(Search for relevant PPT from Home Page)

Websites: : www.youtube.com (Search for relevant videos from Home Page).

Lecture No.	**Topic/ Subtopic to be covered**
1,	Study of different types of Manufacturing Processes.
2	Sheet Metal cutting forming.
3	Welding ,Joining , Painting and finishing
4	Casting ,Machining , & finishing
5	Heat treatment & Machining.
6	Forging & Broaching
7	Grinding , lapping & dynamic balancing
8	Cutting ,drilling, hardening
9	Tempering ,bending ,Pre-stressing & protective coating
10	Final assembly & painting
11	Component eg.cylinder block(Auto.Mfg.Process)
12	eg. Connecting rod(Auto.Mfg.Process)
13	Eg.Crank shaft (Auto.Mfg.Process)

14	Eg leafspring (Auto.Mfg.Process).
Topic 6	**Process Planning and jigs/fixture Design** **Teacher shall implement the methodology/ techniques mentioned in the following table while teaching the topics. Along with this teacher may use additional/alternative methods to make students learning meaningful.**

Knowledge Category	Example/s of category	Teaching methodology
FACT	**Jig & Fixture**	Show the various jigs and fixtures and its components. Make use of PPTs for better understanding of students.
CONCEPT	**Location, Clamping tool, setting**	Explanation with chalk & board initially. Make use of PPTs.
PRINCIPLE	**Principle or location of component in jig or fixture**	Explanation with chalk & board initially. Make use of PPTs.
PROCEDURE	**Jig and fixture design ,Design of drilling jigs Deign of milling fixture**	Demonstrate through PPT/Actual components.
APPLICATION	**Machining Process**	Demonstrate through PPT/Actual components. Videos and animations should be used.

Learning Resources:
Books: 1)Automotive Technology by H.M.Sethi
2) Jigs & Fixtures by P.H.Joshi –Tata McGrawHill

Teaching Aids: BB,PPT,Model,Chart

PPT with Sample:www.slideshare.net(Search for relevant PPT from Home Page),
www.autoparts.com
www.Howstuffwork.com

Websites: : www.youtube.com (Search for relevant videos from Home Page).

Lecture No.	**Topic/ Subtopic to be covered**
1,	Principle of Jigs and fixtures design,

2	Locating device.
3	Types of Locators for different types of surfaces and shape,
4	Design consideration for jigs & fixture design and steps to be followed
5	Features and application of different types of drilling jigs, plate jigs,
6	Features and application of angle plate jigs, Universal jigs
7	Design procedure for simple jigs
8	Essential of milling fixture.
9	Tannin Pins, Setting block.
10	Types of fixture,
11	Special clamping device
12	Design processes for simple fixture
13	Revision on above topic
14	Discussion on probable question asks in MSBTE exam.

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. 02

Instruction to Teacher

1. Teacher should show the single plate clutch.
2. He should explain the necessity of clutch.
3. He should explain the working of clutch

Title : Demonstration on working of single plate coil spring or diaphragm spring clutch. Sketch and describe its working

Prior concept: Power Transmission.

New Concept: location and construction.

Instructions to be given to students
Precautions

i. Apron, belt and shoes should be made compulsory for the practical.
ii. Observe the clutch carefully.
iii. Identify the application of particular clutch.
iv. Handle the clutch and try to operate on model
v. Understand how it works.

Questions

a. Identify the different components.
b. Identify the location of components.
c. Sketch the different components
d. Write the function of each component.
e. Write the function of clutch.

.

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

5.4.1 Laboratory Manuals: Purpose and Utility:
5.4.2 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:**

Roll No.									

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CLASS TEST – 1

Course Name: Production Engineering/Technology
Course Code : PG/PT
Semester : Sixth
Subject : Automobile Engineering and Manufacturing
Marks : 25 **Time: 1 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 Attempt any Three of the following **09 Marks**

a) State three features of Constant mesh Gear Box.
b) State necessity of clutch in vehicle
c) Draw a layout of Automobile vehicle and label the components.
d) Enlist types of component used for Automobile aerodynamics.

Q.2 Attempt any TWO of the following **08 Marks**

a) Describe different types of chassis
b) Draw a neat sketch & explain construction of coil spring.
c) State necessity of final drive & explain working of propeller shaft.

Q.3 Attempt any TWO of the following **08 Marks**

a) Explain function of real axles & their application.
b) Write down classification of automobiles vehicle.
c) Describe the terms of body nomenclature.

Roll No.									

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CLASS TEST – 2

Course Name: Production Engineering/Technology
Course Code : PG/PT
Semester : Sixth
Subject : Automobile Engineering and Manufacturing
Marks : 25 **Time: 1 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 Attempt any Three of the following **09 Marks**

a) State three advantages of disc brake.
b) State three benefits of independent suspension system
c) Define i)Caster ii) Camber iii) Toe-in
d) State the use of trailing link of suspension system.

Q.2 Attempt any TWO of the following **08 Marks**

a) Describe working of telescopic shock absorber.
b) Explain construction & working of Hydraulic Brake
c) Explain construction and working of McPherson strut Assy.

Q.3 Attempt any TWO of the following **08 Marks**

a) Draw a schematic sketch of recirculating ball bearing type steering Gearbox.
b) Explain construction & working of wishbone suspension system.
c) Explain construction & working of rack & pinion steering Gearbox.

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 memorized 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 intents 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.

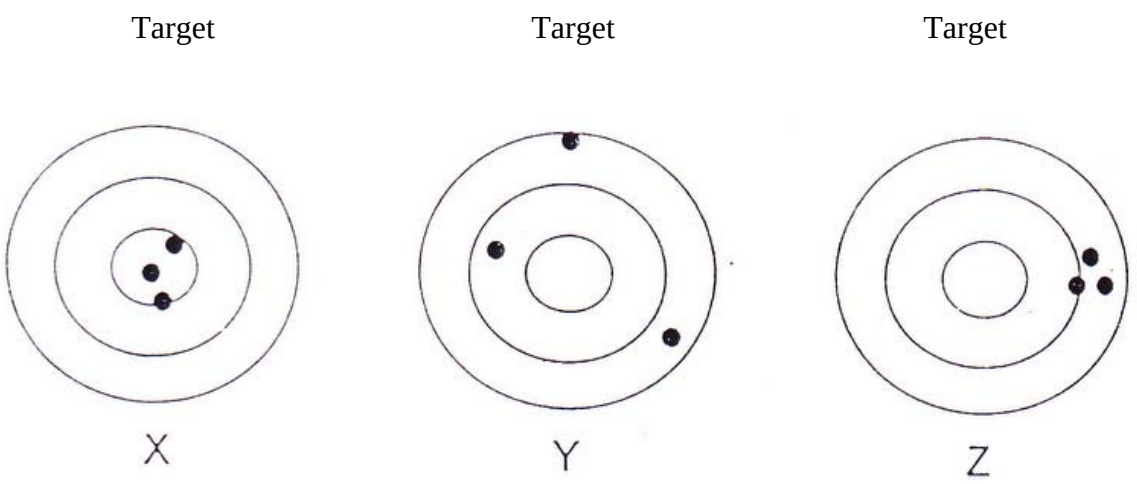
ii) **Examiners Objectivity**

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"



Reliable & Valid Shooting | Unreliable & Invalid Shooting | Reliable but invalid Shooting

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.									

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Maharashtra State Board of Technical Education
Sample Question Paper

Course Name: Production Engineering/Technology
Course Code : PG/PT
Semester : Sixth
Subject : Automobile Engineering and Manufacturing
Marks : 100 **Times: 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 Three **12 Mark**

a) List out different types of leaf spring used in vehicle & draw a neat sketch of any one leaf spring.
b) Write down advantages & disadvantages of disc brakes.
c) Write down different type of chassis.
d) Classify automobile vehicle on the basis of use, capacity ,Wheels & drive

Q.1(B) Attempt any One **06 Marks**

a) Draw layouts of Automobile vehicles with components and their functions.
b) Explain construction and working of epicyclic gear box

Q.2 Attempt any Four **16 Marks**

a) Explain Construction & working of differential.
b) Draw a neat sketch of steering geometry & explain each term.
c) Draw a sketch and describe working of McPherson strut Assy.
d) Differentiate between welding & joining processes in car body manufacturing
e) Write down design procedure for a simple fixture used in Milling.
f) (i) What is clamping device? Why it is essential in milling.
(ii) State Types of Rear Axle

Q.3 Attempt any Four **16 Marks**

a) i) Define the term overdrive.
ii) State the difference between a jig and a fixture.
b) Explain Construction & working of rack & pinion steering gear system.
c) Describe the working of wishbone & trailing suspension
d) Describe any two manufacturing processes used for production of crankshaft..
e) State the application of different types of drilling jigs.

Q.4(A) Attempt any Three of the following **12 Marks**

a) Explain Construction & working of propeller shaft.
b) Draw a neat sketch of drum brake and explain its working

c) Describe independent suspension system.
d) Explain forging & broaching manufacturing process for production of connecting rod.

Q.4(B) Attempt any One of the following 06 Marks

a) If holes are to be drilled in more than one plane which type of jig is used? Draw a neat labeled sketch of such jig
b) Explain the terms in leaf spring.
i) Pre-stessing
ii) Protective coating

Q.5 Attempt any Four of the following 16 Marks

a) State the necessity of clutch & Draw a neat sketch of diaphragm spring type clutch.
b) Explain construction and working of Pneumatics brakes.
c) Explain construction and working of wishbone suspension.
d) What is dynamic balancing? State its application
e) Write down special clamping devices used in design of milling fixture.
f) Describe painting and finishing process in car body manufacturing.

Q.6 Attempt any Four of the following 16 Marks

a) Explain design consideration for jig & fixture.
b) Describe construction & working of rigid axle
c) Explain working principle of power steering
d) Differentiate between Rear axle & front axle..
e) Write down types of locators for different types of surfaces and shapes

Roll No.									

17614

CLASS TEST – 1

Course Name: Production Engineering/Technology
Course Code : PG/PT
Semester : Sixth
Subject : Automobile Engineering and Manufacturing
Marks : 25 **Time: 1 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 Attempt any Three of the following **09 Marks**

a) State three features of Constant mesh Gear Box.
b) State necessity of clutch in vehicle
c) Draw a layout of Automobile vehicle and label the components.
d) Enlist types of component used for Automobile aerodynamics.

Q.2 Attempt any TWO of the following **08 Marks**

a) Describe different types of chassis
b) Draw a neat sketch & explain construction of coil spring.
c) State necessity of final drive & explain working of propeller shaft.

Q.3 Attempt any TWO of the following **08 Marks**

a) Explain function of real axles & their application.
b) Write down classification of automobiles vehicle.
c) Describe the terms of body nomenclature.

Roll No.									

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CLASS TEST – 2

Course Name: Production Engineering/Technology
Course Code : PG/PT
Semester : Sixth
Subject : Automobile Engineering and Manufacturing
Marks : 25 **Time: 1 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 Attempt any Three of the following **09 Marks**

a) State three advantages of disc brake.
b) State three benefits of independent suspension system
c) Define i)Caster ii) Camber iii) Toe-in
d) State the use of trailing link of suspension system.

Q.2 Attempt any TWO of the following **08 Marks**

a) Describe working of telescopic shock absorber.
b) Explain construction & working of Hydraulic Brake
c) Explain construction and working of McPherson strut Assy.

Q.3 Attempt any TWO of the following **08 Marks**

a) Draw a schematic sketch of recirculating ball bearing type steering Gearbox.
b) Explain construction & working of wishbone suspension system.
c) Explain construction & working of rack & pinion steering Gearbox.