CURRICULUM REVISION PROJECT

2012

TEACHER GUIDE FOR

ELECTRICAL TECHNOLOGY
(17331)

THIRD SEMESTER COMPUTER ENGINEERING GROUP

JUNE 2013

MAHARASHTRA STATE
BOARD OF TECHNICAL EDUCATION, Mumbai

I N D E X

1. APPROACH TO CURRICULUM DESIGN

1.1 Background:

MSBTE is introducing the revised curriculum 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.

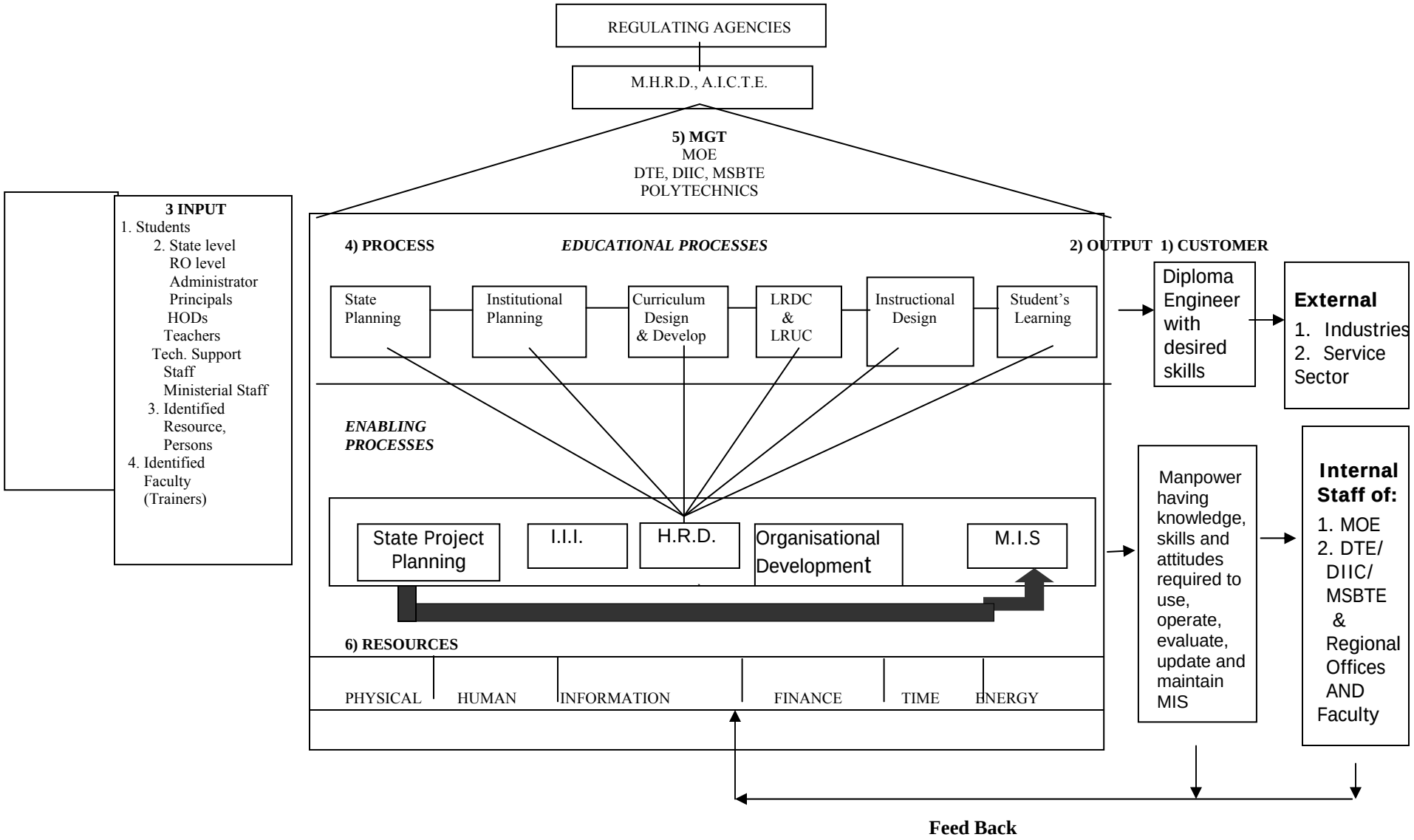


Fig 1 Systems Approach

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.

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:

- Communication skill
- Team work
- Problem solving
- Leadership
- Decision Making
- Presentation skills
- Report writing skills
- Interpersonal skills
- Information search

Technological Skills:

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

Intellectual Skills:

- Use of data sheets, charts, handbooks, standards
- Interpret drawing, circuit diagrams, plant layouts, charts, performance analysis
- Select materials and components
- Locate faults and repairs of faults
- Analyse the data
- Prepare Estimates
- Design simple components
- Use computer software

Motor Skills:

- Measure accurately different parameters
- Operate machines
- Calibrate instruments
- Repair Faults
- Install machines
- Draw plant layout and Prepare detailed drawing
- Conduct various tests and Draw characteristics

1.5 Salient Changes in the curriculum:

- For First Semester Basic Science is divided into two parts- Basic Physics and Basic Chemistry. Theory examination of both parts as well as practical examination of both parts will be conducted on separate days. Sum of theory marks of both parts shall be considered for passing theory examination of Basic Science. Similarly it is applicable to practical examination. It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.
- For second semester Applied Science is divided into two sections- Applied Physics and Applied Chemistry where the theory examination of 50 marks each and practical examination of 25 Marks each will be conducted separately and the minimum passing

marks for Engineering Science will be the combination of both the sections. . It is mandatory to appear for theory and practical examination of both parts. Candidate remaining absent in any examination of any section will not be declared successful for that exam head.

- The components of Development of Life Skills were taught in two semesters. In Development of Life Skills –I the topics related to personal development, such as Learning to Learn Skills, personality development, presentation skills etc. were included. In Development of Life Skills – II the topics related to Team Building, Leadership, group behavior etc. were covered. In the revised curriculum the scope of development of life skills has been broaden to include behavioral science component. Therefore the subject Development of Life Skills – II has been renamed and it is now included at Vth Semester in the revised curriculum under the title Behavioral Science.
- The subject of Professional Practices was introduced to integrate the skills acquired in Development of Life Skills, through technical subjects from second to sixth semester. The experience in implementing the contents of the subject shows that there are limited activities possible in second semester as the technical knowledge given to the students is very limited. Also at sixth semester the student are doing projects in which they are performing many activities included in the Professional Practices and therefore it is proposed that the subject of Professional Practices be prescribed only for three semesters vis. Third, fourth and fifth semesters.
- Introduction of Environment Engineering at fourth Semester for all courses
- From the experience of implementation of Elective Subjects at V and VI semesters in last five years, it is proposed to have only one elective at 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 Electrical Engineering new topic of LED lighting has been added in Illumination Engineering subject. Similarly introduction of residential solar lighting systems, topics like duties and responsibilities of Electrical Inspector, Commercial aspects of power

utilities have also been added. Heating, Ventilation & Air-conditioning (HVAC) has been deleted from the revised curriculum. Subject of Power System Operation has been introduced at VI Semester Electrical Course also.

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.

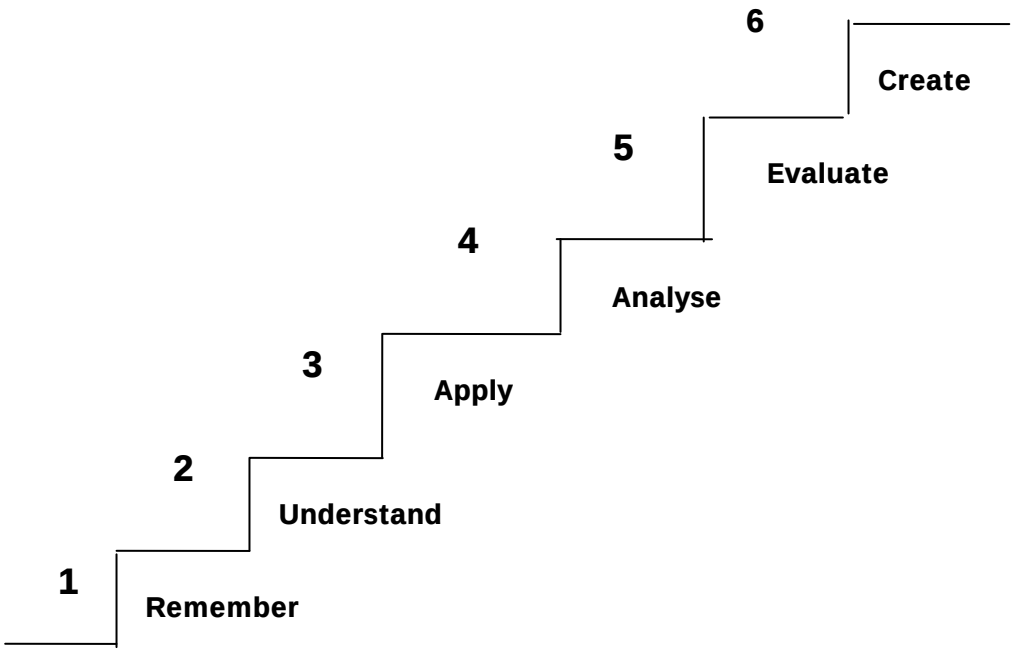
2.3 LEVELS OF LEARNING:

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.

2.3.1 Cognitive Domain:

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

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



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

Description of the Major Levels in the cognitive Domain (Bloom's Taxonomy)	Illustrative General Instructional Objectives	Illustrative verbs for stating specific learning outcomes
Remember – Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required to mind of the appropriate information. This represents the lowest level of learning outcomes in the cognitive domain	Knows common terms, specific facts, basic concepts, principles, methods & procedures	Define, describe, identify label, list, match, name, outline, reproduce, select, state
Understand – This is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words or numbers) by	Understands fact, principles Interprets verbal material, Interprets charts, tables,	Convert, distinguish estimate, explain, extend, generalize,

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.	graphs. Translates verbal material to mathematical formula. Estimates consequences implied in data. Justifies methods & procedures.	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.

2.3.2 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				

2.4 Components of Curriculum:

2.4.1 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.

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

Objectives indicate what is achievable and hence gives direction ot 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.

2.4.3 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.

2.4.4 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.

2.4.5 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 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 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: Computer Engineering Group

Course Code: CO/CD/CM/CW/IF

Semester: Third

Subject Title: Electrical Technology

Subject Code: 17331

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:

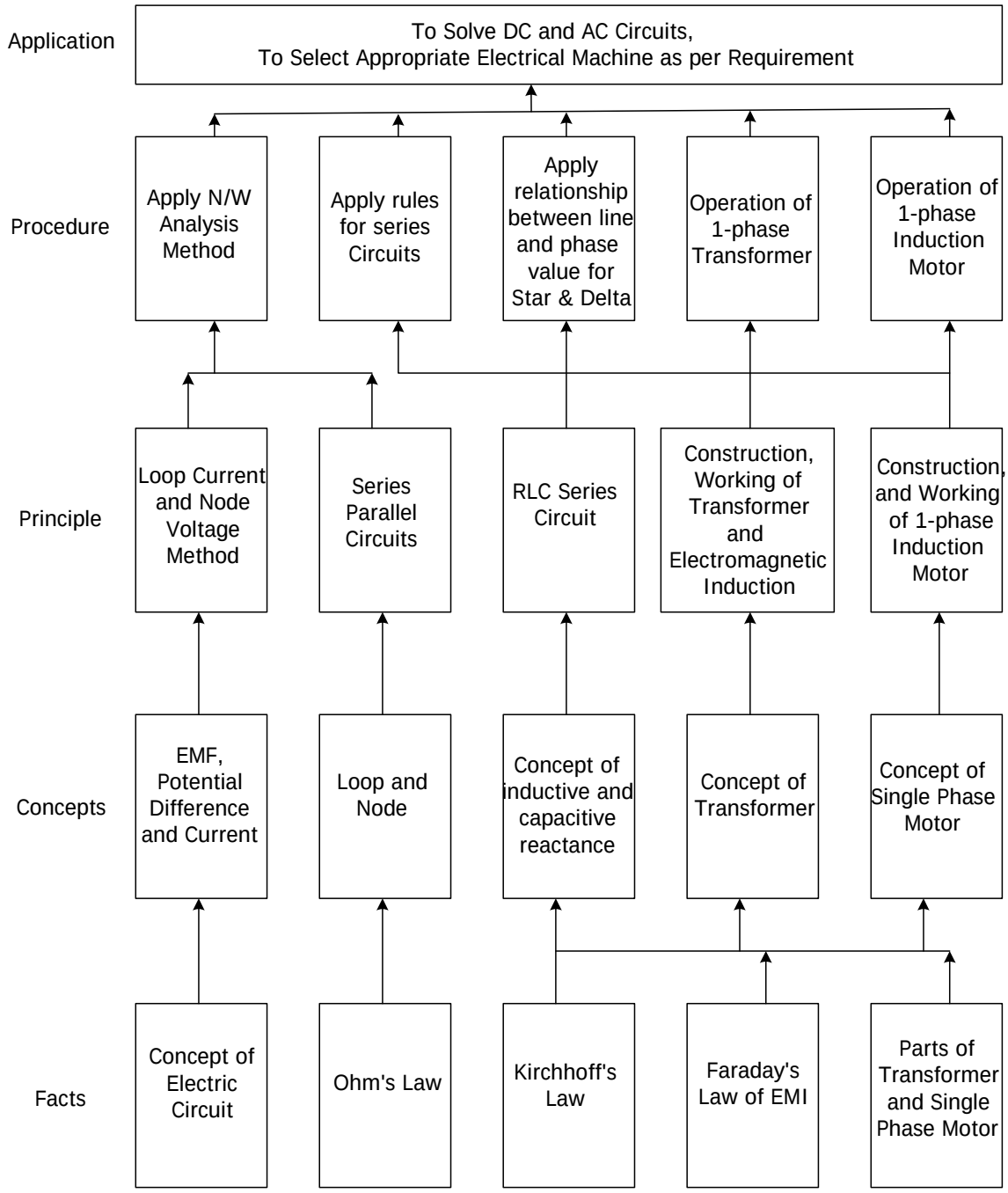
This subject is an allied subject for diploma in computer engineering, computer technology and information technology course. As the present industry job profile requires multi engineering knowledge, this subject gives the basic knowledge of electrical engineering. The technicians & supervisors from all branches of engineering have to deal with various types of electrical gadgets & equipments. Electrical engineering involves the conception, design, development, & production of the electrical or electronic products & systems needed by our technological society. Hence, it is important to study electric circuits, different electrical machines, their principles and working characteristics. This subject covers analysis of ac and dc networks, working principles of commonly used ac motors. The basic concepts studied in this subject will be very useful for understanding of other higher level subjects in further study.

General Objectives:

The student will be able to:

- Know the concepts of D.C. Circuits.
- Understand concept of A.C. Circuits.
- Know the importance of 3 phase circuits.
- Know construction and working of different electrical machines.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: D.C. Circuits **Specific Objectives** ➢ Understand practical use of KCL and KVL ➢ Represent complicated network by single equivalent resistance **Contents:** 1.1 Concept of Emf , Potential Difference, D.C. Current & D.C.Voltage (Symbols and Units) 1.2 Basic Laws and their application: • Ohm's Law • Kirchhoff's Current & Voltage Law • Mesh Loop Current Method (Two loops only) • Node Voltage Method (Two nodes only) 1.3 Simplification of Networks • Series & Parallel Circuits • Star-Delta & Delta-Star Conversion (Simple Numerical on 1.2 and 1.3)	**08**	**12**
Topic 2: A.C. Fundamentals **Specific Objectives** ➢ Understand nature of sine waveform & calculate its parameters ➢ Identify inductive and capacitive load **Contents:** 2.1 Basics of Electromagnetism • Concept of magnetic Flux • Concept of Reluctance • Faraday's Law of Electromagnetic Induction • Lenz's law • Statically &Dynamically Induced EMF. • Concept of Inductance, Capacitance, Inductive & Capacitive Reactance 2.2 Sinusoidal Representation With Equation of Alternating V & I (08) • Concept of Angular Velocity, Frequency, Cycle &Time Period • Concept of Peak Value, Average Value & RMS Value	**10**	**26**

• Concept of Form &Peak Factor 2.3 Phase of AC Quantities (Definition & phasor representation) • Phase and Phase Difference • In-Phase Quantity • Lagging Quantity • Leading Quantity 2.4 Behavior of AC Circuits (Waveforms, Equations & Phasor Diagrams) • AC Circuits Containing Resistance Only • AC Circuits Containing Inductance Only • AC Circuits Containing Capacitance Only (Simple Numerical on 2.2 & 2.4)		
Topic 3: AC Series Circuit **Specific Objectives** ➢ Understand concept of impedance ➢ Distinguish between active, reactive and apparent power **Contents:** 3.1Concept of Impedance and Impedance Triangle 3.2 Concept of Power Factor and Its Significance 3.3 Phasor Diagram, Voltage and Current Equation • RL Series Circuit • RC Series Circuit • RLC Series Circuit and series resonance 3.4 Active, Reactive and Apparent power, Power Triangle 3.5 Measurement of single phase power using Dynamometer Type wattmeter (Simple Numerical on 3.3 and 3.4)	**10**	**20**
Topic 4: Three Phase Circuits **Specific Objective** ➢ Distinguish between 1 phase and 3 phase a.c. nature ➢ Develop balanced load. **Contents:** 4.1 Advantages of Three Phase Circuits over single phase circuits 4.2 Concept of Three Phase Supply, Its Waveforms Representations & Phase Sequence, Concept of Balanced Load. 4.3 Star Connected Balanced System • Relation Between Phase and line Current • Relation Between Phase and line Voltage • Equation for Three Phase Power	**06**	**14**

• Phasor Diagram 4.4 Delta Connected Balanced System • Relation Between Phase and Line Current • Relation Between Phase and line Voltage • Equation for Three Phase Power • Phasor Diagram (Simple Numerical on 4.3 & 4.4)		
Topic 5 : Electrical Machines **Specific Objectives** ➢ Able to select motor depending on application ➢ Able to specify transformer w.r.t. specifications. **Contents:** 5.1 Single Phase Induction Motor : Principle of Working, Operation and Application of • Resistance Split Phase Motors • Capacitor Start Motors • Shaded Pole Motors • Universal Motors 5.2 Transformer Construction • Construction and Working Principle • Classification of Transformers 5.3 Transformer Operation • Emf Equation (No Derivation) • Voltage and Current Ratio • Efficiency and Voltage Regulation 5.4 Auto Transformer • Construction and Working • Comparison With Two Winding Transformer	**10**	**20**
Topic 6 : Electrical Safety **Specific Objectives** ➢ Aware about earthing need ➢ Able to identify cause of problem **Contents:** 6.1 Earthing of Electrical Equipment • Pipe earthing • Plate earthing 6.2 Fuses	**04**	**08**

• Classification of Fuses and basic terms related with it • Miniature Circuit Breaker • Comparison between fuse and MCB 6.3 Electric shock and its effects • Factors Affecting Lethality of Electric shock • Precautions Against Electric Shock • Handling Shock Victims		
TOTAL	**48**	**100**

Intellectual Skills:

1. Identify and select suitable electrical instruments for measurement
2. Identify and give specifications of electrical motors and transformers
3. Distinguish between 1 phase and 3 phase nature.
4. Identify safety equipments required.
5. Decide the procedure for setting experiments.

Motor Skills:

1. Draw wiring diagram
2. Make wiring connections to connect electrical equipments and instruments.
3. Measure electrical power and other electrical quantities.
4. Use of safety devices while working.

List of Practical:

1. Verification of Kirchhoff's laws.
2. Verification of star-delta conversion or delta-star conversion.
3. Observe sine wave of 1 KHz, 2 V_{p-p} on CRO and determine its time period, RMS, average value.
4. To determine the resistance, impedance and inductance of a choke coil. (Use of D. C. source for measurement of resistance and A.C. source for measurement of inductance is expected)
5. To draw vector diagram and to determine power factor of R-L-C series circuit.
6. To determine the relationship between line and phase values in three phase balanced star and delta connected load.
7. To determine transformation ratio of single phase transformer.

8. To determine efficiency and regulation of transformer.
9. To prepare wiring for one lamp control using 2 switches.

Note: All the above 09 experiments are compulsory.

List of Assignments:

1. Four Mathematical Assignments, each of minimum 25 problems on topics 1 to 4.
2. Six Assignment based on theory questions, each of minimum 20 questions from all topics.

Learning Resources:

1. Books:

Sr.No.	Author	Title	Publisher
1.	R.S.Ananda Murthy	Basic Electrical Engineering	PEARSON
2.	S.N. Singh	Basic Electrical Engineering	PHI Learning
3.	D.C.Kulshreshtha	Basic Electrical Engineering	Mc Graw Hill
4.	B.L.Theraja	Electrical Technology Vol – I and II	S.Chand and Co.

2. Websites:

- www.wikipedia.org
- http://xiendianqi.en.made-in-china.com/
- http://ewh.ieee.org/soc/es/
- http://ecmweb.com/mag/electric_minimizing_ac_induction/
- http://www.electrical-technologies.com/

3. List of Equipments:

1. D. C. Power Supply
2. Different kits as per practical list
3. CRO
4. Signal Generator
5. 1 phase Transformer
6. Analog/Digital Multimeters
7. Connector, banana pins, crocodile pins

5. IMPLEMENTATION STRATEGY:

5.1 Planning of Lectures for a Semester with Content Detailing:

<table>
<tr><td>Topic 1</td><td>Name: D.C. Circuits
Facts: Ohm law, voltage drop, Kirchhoff's law.

Concepts: 1. Emf
2. Potential Difference
3. Branch, loop, mesh, node
4. Star to Delta and Delta to Star Transformations

Principles: 1. Loop current method
2. Node voltage method
3. Series and parallel circuits

Reference Material: Books, notes, suggestion from experts, circuits videos etc.
Books:

Title: 1. Electrical technology- vol 1- by B. L. Thereja
2. Basic electrical engineering- by V. K. Mehta
3. Basic electrical engineering – by C. L. Wadhwa
4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak
5. Basic Electrical Engineering- by V.N. Mittal.

Teaching Aids:
1. Animated videos,
2. Demo model of physical Resistors, source etc.

Websites 1. www.youtube.com
2. www.howstuff.com
3. www.nptel.iitm.ac.in
4. www.openbook.com</td></tr>
<tr><td>Lecture No.</td><td>Topic/ Subtopic to be covered</td></tr>
<tr><td>1</td><td>• Discussion about steps of invention of electricity. Since inception till 1877 D C supply was only source of electrical supply. In 1877 Michal Faraday brought the revolution in generation of AC supply.
• History about industrial revolution, and necessity of electricity to drive the revolution.
• Compare electrical energy with other forms of energies and elaborate its advantages over others. e.g. In early days, water lifting from well was done with the help of Animals and human beings i.e. Mechanical work was done, but nowadays, same work is conveniently done by using</td></tr>
</table>

	electrical motors. • Specify equipments which work on electrical Energy in the class room. e.g. fan, lights. • Contribution of scientist Michael Faraday in the generation of ac electrical energy. • Describe the component of curriculum with their importance, which helps the implementation of curriculum and learning by students ➢ **Concept of Emf , Potential Difference, D.C. Current & D.C.Voltage (Symbols and Units)** • With the help of molecular theory following concepts can be explained. What is atomic structure of matter? It contains: • Protons(positively charged), • Electrons (Negatively charged), • Neutrons (Charge less). • Addition and extraction of electrons through atom, results into formation of the electrical charge. • Definition of electric current and voltage with unit. • Definition of electric potential with unit • Definition of potential difference with unit • Definition of EMF with unit Explain above concept with following examples - Analogy of water tanks placed at different levels of water. The flow of water takes place from higher level to lower level, the levels of the two tanks is equal. Teachers can take the help of videos or PPT. Analogy: 1. Pipe (connecting two tanks) = Conductor 2. Difference in Level of water in the tank= Potential difference 3. Pump to maintain the water level = electrical source 4. Friction due to Roughness of Pipe = resistance 5. Flow of water through pipe = flow of current
2	➢ **Basic Laws and their application:** • **Ohm's Law** • Describe simple electric circuit with its elements. • State and Explain ohm's law with the help of simple electric circuit. • **Kirchhoff's Law** • Explain the meaning of node or junction. (eg. A nearby railway junction or a square in your town) • Show the current distributed at node in two loop circuit. • State and Explain Kirchhoff's current law (KCL). • Explain the concept of voltage drop. • State and Explain Kirchhoff's voltage law (KVL).

	• Explain the sign conventions related to KVL by drawing simple two loop electric circuit. • Explain Mesh Loop Current Method (Two loops only) with simple electrical circuit. • Explain Node Voltage Method (Two nodes only) with simple electrical circuit.
3	➢ **Numericals on above topics.**
4	➢ **Simplification of Networks** • Series & Parallel Circuits • Resistance in series:- Draw diagram of minimum three resistances connected across single voltage source • Derive equation of equivalent resistance by using ohms law • Resistance in parallel:- Draw diagram of minimum three resistances connected across single voltage source • Derive equation of equivalent resistance by using ohms law • Solve minimum five numericals • Practical applications of series and parallel circuit, e.g. decorative lighting are connected in series, house wiring is connected in parallel.
5	➢ **Star-Delta & Delta-Star Conversion** • Explain need of star and delta connection. • Draw diagram of three resistances in star connection- it is so named because it appears like a star in the Greek letter. • Draw diagram of three resistances connected in delta connection • Write equations to convert star to delta and vice-versa.
6	➢ **Numericals on above topics.**
7	➢ **Practice on numerical.**
8	➢ **Revision of contents of Topic 1 and give assignments.**
Topic 2	**Name: A.C. Fundamentals** Facts: time, cycle, a.c., Inductor, Capacitor Concepts: 1. Magnetic Flux 2. Reluctance 3. Inductance, Capacitance, Inductive & Capacitive Reactance 4. Angular Velocity, Frequency, Cycle &Time Period 5. Peak Value, Average Value & RMS Value 6. Form & Peak Factor 7. Phase

	Principles: 1. Behavior of AC Circuits Containing Resistance only 2. Behavior of AC Circuits Containing Inductance only 3. Behavior of AC Circuits Containing Capacitance only Reference Material: • Books, notes, videos and PPT etc. Books: 1. Electrical technology- vol 1- by B. L. Thereja 2. Basic electrical engineering- by V. K. Mehta 3. Basic electrical engineering – by C. L. Wadhwa 4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak Teaching Aids: • Animation videos, Websites: 1. www.youtube.com 2. www.howstuff.com 3. www.openbook.com
Lecture No.	Topic/ Subtopic to be covered
1	➢ **Basics of Electromagnetism** • Concept of magnetic flux • Concept of Reluctance • Compare magnetic circuit with electrical circuit • Define magnetic flux and Reluctance • Faradays law of electromagnetic induction • Explain concept of induction • Explain concept of electromagnetic induction • State and explain with diagram Faraday's law of electromagnetic induction • Faraday's first law, Faraday's second law
2	• Derivation of magnitude of induced emf using basic principle • Discuss the factors affecting induced emf. • Explain the significance of negative sign in the emf equation • State the types of emfs • Explain with diagram dynamically induced emf • Derivation of Dynamically induced emf • Explain with diagram Statically induced emf • List the types of statically induced emf

	• State and explain Lenz's law for statically induced emf
3	➢ **Concept of Inductance, Capacitance, Inductive &Capacitive Reactance** • Mention different insulating materials/ magnetic material/ dielectric materials • Symbol of inductor • Define the inductor • State mathematical relation between inductance, weber-turns and current • Define inductive reactance • Symbol of capacitor • Define the capacitor • State mathematical relation between capacitance, voltage and charge • Define capacitive reactance
4	➢ **Sinusoidal Representation With Equation of Alternating V & I** • Draw and explain the sinusoidal waveform. • Define and explain terms related to sinusoidal waveform: Cycle, Frequency, Time, Amplitude and Angular Velocity. • Concept of Peak Value, Average Value & RMS Value • Define the terms Peak Value, Average Value & RMS Value for sinusoidal a.c. • Concept of Form & Peak Factor • Define the terms Form & Peak Factor for sinusoidal a.c.
5	➢ **Numericals on above topics.**
6	➢ **Phase of AC Quantities (Definition & phasor representation)** • Draw and explain for the sinusoidal waveform: 1. Phase and Phase Difference 2. In-Phase Quantity 3. Lagging Quantity 4. Leading Quantity • Define Phase, Phase Difference, In-Phase Quantity, Lagging Quantity and Leading Quantity.
7	➢ **Behavior of AC Circuits (Waveforms, Equations & Phasor Diagrams)** • Behavior of AC Circuits Containing Resistance Only • Derive expression of instantaneous current, maximum current and power for AC Circuits Containing Resistance Only • Behavior of AC Circuits Containing Inductance Only • Derive expression of instantaneous current, maximum current and power for AC Circuits Containing Inductance Only • Behavior of AC Circuits Containing Capacitance Only • Derive expression of instantaneous current, maximum current and power for AC Circuits Containing Capacitance Only

8	➢ **Numericals on above topics.**
9	➢ **Practice on numerical.**
10	➢ **Revision of contents of Topic 2 and give assignments.**
Topic 3	**Name: AC Series Circuit** Facts: Voltage, Current and Power Concepts: 1. Impedance, Impedance Triangle 2. Power Factor 3. Active and Reactive Power 4. Power Triangle Principles: 1. RL, RC and RLC series circuit Reference Material: • Books, notes, videos and PPT etc. Books: 1. Electrical technology- vol 1- by B. L. Thereja 2. Basic electrical engineering- by V. K. Mehta 3. Basic electrical engineering – by C. L. Wadhwa 4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak Teaching Aids: • Animation videos Websites: 1. www.youtube.com 2. www.howstuff.com 3. www.openbook.com
Lecture No.	Topic/ Subtopic to be covered
1	➢ **Concept of Impedance and Impedance Triangle** • Explain the components of impedance triangle • Define the components of impedance triangle • Relations from impedance triangle
2	➢ **Concept of Power Factor and Its Significance** • Define Power Factor • Explain its concept and significance by giving example • Explain the effect of variation of Power Factor on power consumption

3	➢ **Phasor Diagram, Voltage and Current Equation RL Series Circuit** • Derive expression for Voltage, Current and Power for RL Series Circuit • Draw phasor diagram for RL Series Circuit • Solve numericals on RL Series Circuit
4	➢ **Phasor Diagram, Voltage and Current Equation RC Series Circuit** • Derive expression for Voltage, Current and Power for RC Series Circuit • Draw phasor diagram for RC Series Circuit • Solve numericals on RC Series Circuit
5	➢ **Phasor Diagram, Voltage and Current Equation RLC Series Circuit** • Derive expression for Voltage, Current and Power for RLC Series Circuit • Draw phasor diagram for RLC Series Circuit • Solve numericals on RLC Series Circuit
6	➢ **RLC Series resonance** • Define Series resonance • Condition for series resonance • Solve numericals on RLC Series Resonance
7	➢ **Active, Reactive and Apparent power, Power Triangle** • Components of Power Triangle • Define Active, Reactive and Apparent power • Relations from power triangle • Numericals on Active, Reactive and Apparent power, Power Triangle
8	➢ **Measurement of single phase power using Dynamometer Type wattmeter** • Draw and Explain circuit diagram for Measurement of single phase power using Dynamometer Type wattmeter • Demonstrate this method in the laboratory
9	➢ **Practice on numerical.**
10	➢ **Revision of contents of Topic 3 and give assignments.**
Topic 4	**Name: Three Phase Circuits** Facts: 1 phase a.c., 3 phase a.c. Concepts: 1. Three Phase Supply 2. Balanced load 3. Phase Sequence 4. Line and Phase Voltage 5. Line and Phase Current

	Principles: 1. Star Connected Balanced System 2. Delta Connected Balanced System Reference Material: • Books, notes, videos and PPT etc. Books: 1. Electrical technology- vol 1- by B. L. Thereja 2. Basic electrical engineering- by V. K. Mehta 3. Basic electrical engineering – by C. L. Wadhwa 4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak Teaching Aids: • Animation videos and charts Websites: 1. www.youtube.com 2. www.howstuff.com 3. www.openbook.com
Lecture No.	Topic/ Subtopic to be covered
1	➢ **Advantages of Three Phase Circuits over single phase circuits** ➢ **Concept of Three Phase Supply,** • It's Waveforms Representations • Define Phase Sequence • Concept of Balanced Load
2	➢ **Star Connected Balanced System.** • Relation Between Phase and Line Current • Relation Between Phase and line Voltage • Equation for Three Phase Power • Phasor Diagram
3	➢ **Numericals on Star Connected Balanced System.**
4	➢ **Delta Connected Balanced System.** • Relation Between Phase and Line Current • Relation Between Phase and line Voltage • Equation for Three Phase Power • Phasor Diagram
5	➢ **Numericals on Delta Connected Balanced System.**
6	➢ **Revision of contents of Topic 4 and give assignments.**

Topic 5	**Name: Electrical Machines** Facts: Parts of 1- phase motor & Transformer, Faraday's Law of Electromagnetic Induction Concepts: 1. Concept of 1- phase motor 2. Concept of Transformer Principles: 1. Construction and working of Resistance Split Phase Motors 2. Construction and working of Capacitor Start Motors 3. Construction and working of Shaded Pole Motors 4. Construction and working of Universal Motors 5. Construction and working of Transformers Reference Material: • Books, notes, videos and PPT etc. Books: 1. Electrical technology- vol 1- by B. L. Thereja 2. Basic electrical engineering- by V. K. Mehta 3. Basic electrical engineering – by C. L. Wadhwa 4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak Teaching Aids: • Animation videos and charts Websites: 1. www.youtube.com 2. www.howstuff.com 3. www.openbook.com
Lecture No.	Topic/ Subtopic to be covered
1	• Introduce concept of rotating magnetic field • Production of rotating magnetic field in single phase motor • Introduce concept of torque
2	➢ **Single Phase Induction Motor** • Explain with need diagram Principle of Working and Operation • Applications
3	➢ **Resistance Split Phase Motors** • Explain with need diagram Principle of Working and Operation • Applications
4	➢ **Capacitor Start Motors** • Explain with need diagram Principle of Working and Operation

	• Applications
5	➢ **Shaded Pole Motors** • Explain with need diagram Principle of Working and Operation • Applications
6	➢ **Universal Motors** • Explain with need diagram Principle of Working and Operation • Applications
7	➢ **Transformer** • Construction • Working Principle • Classification of Transformers **Note: Refer Sample lesson plan at the end of this table.**
8	➢ **Transformer Operation** • Emf Equation (No Derivation) • Define Voltage and Current Ratio • Define Efficiency and Voltage Regulation
9	➢ **Auto Transformer** • Explain with neat diagram Construction and Working of Auto Transformer • Comparison with Two Winding Transformer
10	➢ **Revision of contents of Topic 5 and give assignments.**
Topic 6	**Name: Electrical Safety** Facts: Electric shock Concepts: 1. Earthing 2. Fuse Principles: 1. Earthing of Electrical Equipment 2. Electrical Safety Reference Material: • Books, notes, videos and PPT etc. Books: 1. Electrical technology- vol 1- by B. L. Thereja 2. Basic electrical engineering- by V. K. Mehta 3. Basic electrical engineering – by C. L. Wadhwa 4. Basic concepts of electrical engineering – by Kuldeep Sahay, Shivendra Pathak

	Teaching Aids: • Animation videos and charts Websites: 1. www.youtube.com 2. www.howstuff.com 3. www.openbook.com
Lecture No.	Topic/ Subtopic to be covered
1	➢ **Electric shock and its effects** • Factors affecting severity of electric shock • Precautions against electric shock • Procedure of handling shock victims
2	➢ **Earthing of Electrical Equipment** • Give importance of Earthing • Explain with labelled diagram Pipe earthing • Explain with labelled diagram Plate earthing
3	➢ **Fuses** • Classification of Fuses • Define basic terms related with Fuse • Miniature Circuit Breaker • Comparison between fuse and MCB
4	➢ **Revision of contents of Topic 5 and give assignments.**

Sample Lesson Plan

Subject: Electrical Technology (Electrical Technology Computer Engineering Group) / Electrical Engineering (Electronics Engineering group)

Topic: Transformer

General Objective: To explain the principle of working of transformer

Specific Objectives: At the end of the class students should be able to-

- Identify applications/appliances/equipment that require transformer
- Differentiate a step-up transformer from a step-down transformer
- State the principle of working of single phase transformer
- Relate the voltage and current in primary and secondary coils to the number of turns

Time: 1 hour

Teaching Aids:
Actual transformer of about 1 kVA in which transformer core and both the windings are visible
Pictures of transformer applications (Transparencies or Power point slides)
Diagrams /drawings of transformers (Transparencies or Power point slides)
Chart developed by NITTTR Bhopal

Learning Activities:

1. Review/Motivation (10 min):

A day prior to the class, ask students to compile a list of appliances/applications where operating voltage is not equal to the supply voltage. Recall that activity and discuss various applications and list student responses on board, e.g., mobile charger, voltage stabilizer, distribution transformer, TV set, computer monitor to supply high voltage (15000 V) to picture tube etc.

Show pictures of transformer applications using OHP/LCD projector.

Introduce the lesson with this feedback and explain the function of transformer.

Explain the meaning of step-up and step-down transformer and their practical examples.

2. Lesson Discussion (30 min):

Construction (5 min) - Show actual transformer and show laminated core, primary and secondary windings, insulation between two windings and core.

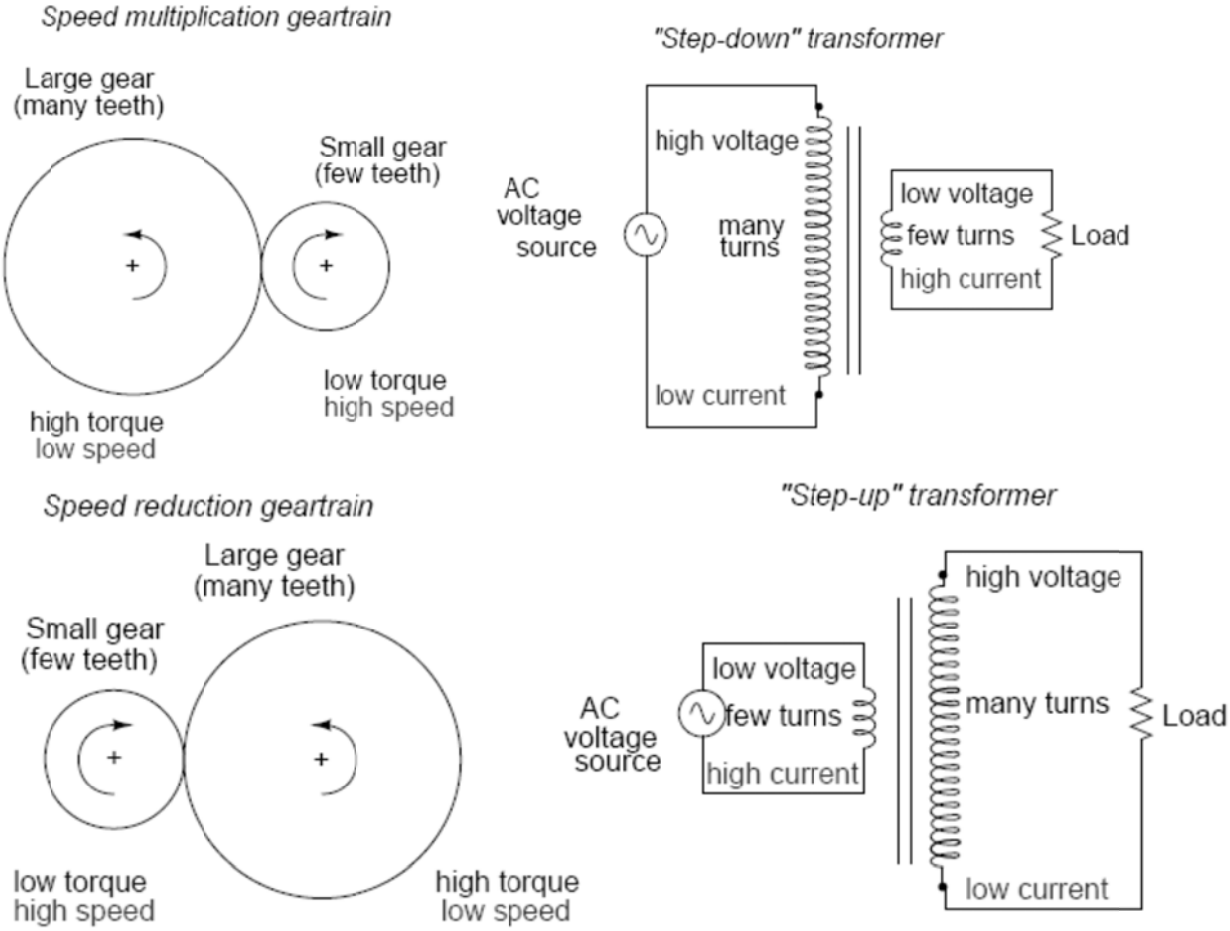
Show schematic diagram of transformer showing primary and secondary windings, voltage levels, currents etc. with the help of OHP or LCD projector and let the students

identify the type of transformer shown, primary and secondary quantities, i.e., V_1, V_2, I_1, I_2, N_1 and N_2.

Principle of working (10 min) – Ask questions to revise the nature of alternating current, magnetic effect of electric current, Faraday's law of electromagnetic induction, self and mutual induction and explain how the power is transferred from primary to secondary with change in voltage level without change in frequency.

Transformation Ratio K (15 min) - Show schematic diagram of transformer showing primary and secondary voltage levels and number of turns. Ask the students to calculate N_2/N_1 and V_2/V_1 and explain the relation between the number of turns and voltage. Explain the concept of emf/turn and lead the discussion to $N_2/N_1 = V_2/V_1 =$ Transformation ratio K.

Recall power equation $P = VI$ and for ideal transformer $V_1 I_1 = V_2 I_2$. Also use the following analogy for better understanding -



Finally lead the discussion to K = $N_2/N_1 = V_2/V_1 = I_1 / I_2$.

3. Assessment (5 min):

Show the table using OHP or LCD

Transformer	A	B	C	D
Input voltage (V)	240	120	50	100
Input turns	1000	1000	1000	2000
Output turns	500	100	2000	2000

Questions Answers -

Which transformer(s) -

1. is/are step-up transformer(s)?
2. has/have the same output voltage as input voltage?
3. has/have turns ration of 10:1?
4. has/have output voltage of 12V?
5. is/are step-down transformer(s)?

4. Assignment (5 min):

Ask the students to -

1. Look in neighborhood and locate where you can find transformers.
2. Research on how electrical energy from power plant is distributed up to the consumers.

5.2 Planning and Conduct of Test:

Two tests of 25 marks each should be conducted during the semester.

- Each test should be of one hour duration.
- Format of question paper for tests should be as per the sample question paper.
- Tests should be conducted as per the academic calendar of MSBTE and portion for each test shall be declared well in advance.
- There are no minimum passing marks for the test.
- Discuss the class test question paper and its model answer in the class.
- Display the model answers of class test question paper on notice board.
- Assessment of the test papers shall be done by highlighting the mistakes.
- Test papers should be shown to students and teacher shall give the feedback to students about their performance.
- Tests marks should be displayed on the notice board.

5.3 Details about conduct of assignments:

- For giving the assignments the class of 60 students should be divided in 6 groups (of 10 students each) according to the roll numbers of the students.
- All the students should be asked to keep one separate note book for the assignments.
- After completion of the topic one assignment should be given on that topic to each group of students.
- The assignments for each group should be different, i.e. repetition of questions should be avoided.
- Preferably, the assignments should cover all the subtopics of the topic.
- Number of Numericals (i.e. problems) should be given in the assignments.
- To save the time, the assignments should be displayed on the notice board of the department; and students should be asked to note down the same.
- Assignments given should be regularly checked and feedback should be given to the students.

5.4 Strategies for Conduct of Practical:

5.4.1 Approach for design of Manual:

The experiments included in the laboratory manual shall help the students to develop motor, generic, and intellectual skills.

- Grid table is given in the laboratory manual; teacher shall focus on grid table & understand the skills to be developed among students through the performance of particular experiment.
- The new concepts based on prior concepts & the concept structure which links with the content, shall be explained by the teacher.
- Teacher shall involve the students to get familiar with the electrical engineering laboratory through ‘Know your laboratory’ experiment.
- Stepwise calculations are provided for better understanding of the students.
- Thought provoking questions are provided at the end of the experiment. Teacher shall give some selected questions to write, additional questions can also be given if required.
- No marks shall be allotted for writing answers of questions given in the manual.

Alternative Method for conducting Practical No.3

Experiment: To study the condition of resonance in RLC series circuit.

Objectives: After completing this experiment you will be able to –

- State phase relationship between voltage and current in an AC circuit with resistance, inductance and capacitance in series.
- Simulate and analyze the RLC series circuits using PSpice.
- Understand the use of AC sweep analysis in PSpice.
- Explain the variation of resistance, inductive reactance and capacitive reactance with change in frequency.
- Explain the necessary conditions for series resonance.
- Determine the resonant frequency and bandwidth of RLC series circuit.

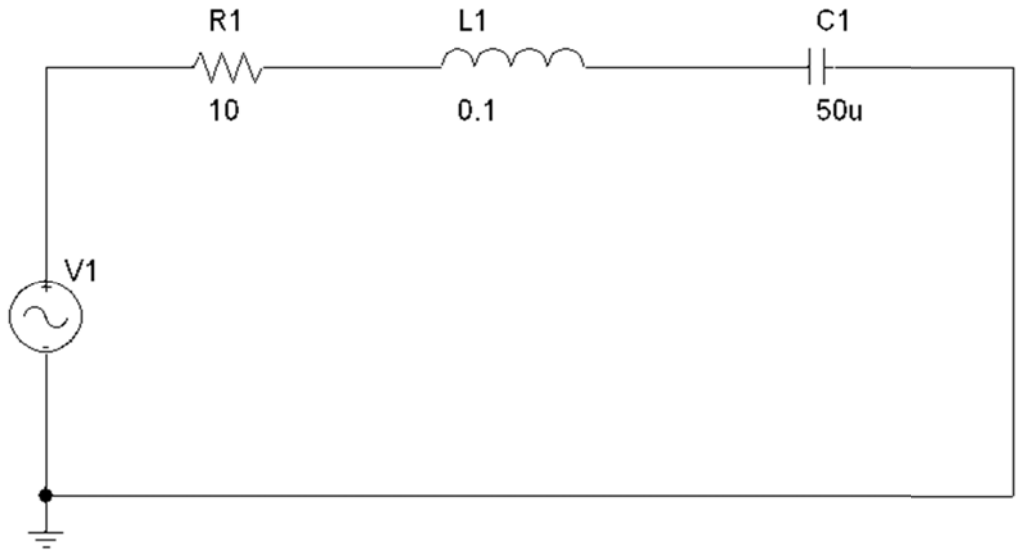
Introduction: The response of a circuit containing both inductors and capacitors in series depends on the frequency of the driving voltage or current. Resonance occurs when the inductive and capacitive reactances cancel each other. Resonance is the fundamental principle upon which most filters are based. These filters allow us to tune radios, televisions, cell phones and many other devices which are essential for modern living.

Simulation Using PSpice-student version: PSpice is circuit simulation software which is commonly used to test and analyze the operation of circuit designs on a computer. PSpice-student may be downloaded for free from net. It is very easy to use and it is used at a number schools and universities.

Parts required: VSIN, r, L, c, GND_EARTH.

Analysis Required: Bias Point Details, AC sweep.

Circuit Diagram:

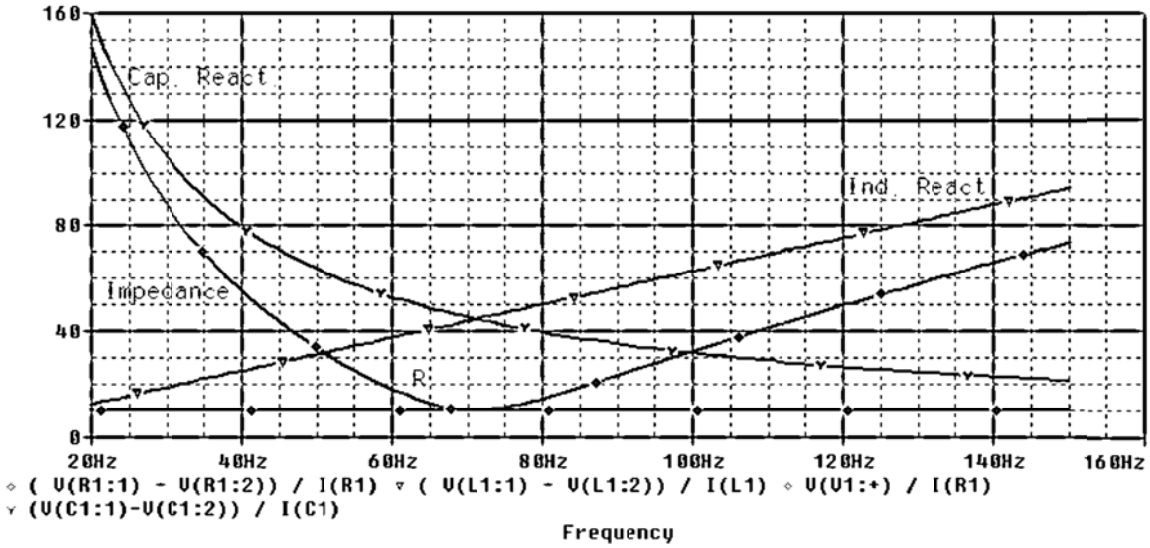


Procedure:

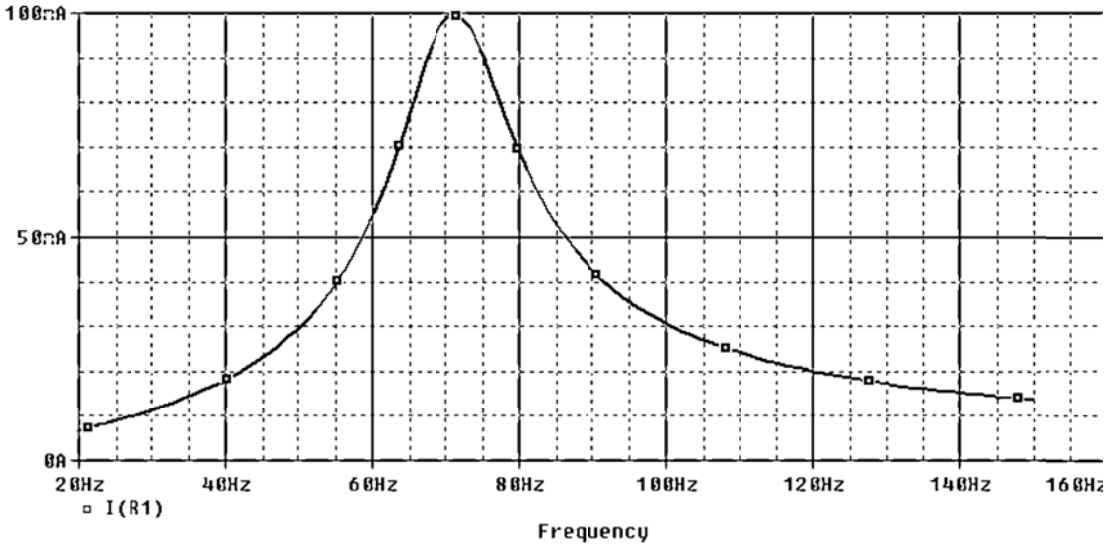
- Start Schematic, the schematic editor window appears.
- Place all the parts shown above on a schematic page.
- Connect these parts using wires. You can also place text or graphics.
- From the Analysis menu, select Setup to display the Analysis setup dialog box.
- For this experiment select Bias Point Details analysis and AC sweep analysis.
- Set the sweep frequency as 20 Hz to 150 Hz.
- Simulate your circuit by selecting Simulate from the Analysis menu or by clicking on the Simulate button.
- The simulation creates output files with a .OUT extension, and if the simulation completes successfully, produces a file with a .DAT extension. All viewpoint and sensor displays are automatically updated.
- If there are errors during the simulation, select View Output from the File menu. Remove all the errors and again simulate the circuit.
- Obtain the plots of R, X_L, X_C and I with respect to frequency. You will get the plots as shown below.

Plots:

1) Variation of inductive reactance, capacitive reactance, resistance and impedance with change in frequency –



2) Variation of current with change in frequency –



Review Questions:

1) Determine the resonant frequency, Bandwidth, Q factor of the simulated circuit using PSpice and verify your answers by mathematical calculations.
2) Determine the voltage across resistance, voltage across inductance, voltage across capacitance and current at resonance using PSpice. Verify your answers by mathematical calculations.

5.4.2 Suggestions for effective conduct of practical and assessment:

- Teacher shall schedule the experiments date wise and display the same in advance.
- Students shall be instructed to go through the experiment in advance which is scheduled on the day.
- Teacher shall explain the prior concepts, new concepts and concept structures to the students before performing the experiment.
- Explanation of the procedure or if required demonstration of the experiment shall be given by the teacher.
- Students should do the necessary electrical connections as per circuit diagram and check it from teacher.
- Students should be asked to use rough note book for noting down the observations and for making calculations.
- Teacher shall check the observations & calculations and suggest corrections (if any), before students enters the observations & calculations in the manual.
- The continuous assessment i.e. weekly checking shall be done as per CIAAN norms.
- The marks to the experiment shall be given by considering three or four parameters.

5.4.3 Preparation for conduct of practical

- As circuit diagrams are not given in the laboratory manual, read the manual carefully and develop the circuit diagrams as per the procedure, experimental set up and apparatus available in the laboratory.
- Check that the apparatus required for the experiments are in good working condition.
- Check that earthing is provided & maintained properly.
- Instructions (safety precautions) while working in the Electrical Engineering Laboratory are given in the manual; read these instructions and if possible display these instructions in the laboratory and ask the students to carefully read & follow the instructions.
- Safety charts as well as other informative charts, such as artificial respiration chart should be displayed in the laboratory.
- For experiment on storage batteries; if possible arrange the visit to battery charging and reconditioning workshop.
- First aid box, fire extinguisher should be provided in the laboratory.

6. Mode of assessment:

6.1 Class Test:

It is proposed that there will be two tests each of 25 Marks. The tests will be conducted as per the MSBTE Schedule

6.1.1 Guidelines for Setting Class Test Question Paper:

From the Academic Year 2012-13, 'G' Scheme is being implemented progressively. Following guidelines have to be followed for conducting Test Examinations at Institution Level.

1. Total of Test 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). (Institutes should maintain Subject wise Record of Test Marks in Register.)
2. Each Test paper will have Three Questions:
   i) Question 1 will be for NINE marks. This question will have each bit of three marks and students will have to attempt any THREE out of FOUR bits.
   ii) Question 2 & 3 will be for EIGHT marks each. These questions will have each bit of FOUR marks and student has to attempt any TWO out of THREE bits.
   OR
   These questions have each bit of EIGHT and student has to attempt any ONE out of TWO bits.
   Depending upon the level and scope the subject Teacher can set both questions 2 & 3 having each bit of four marks OR eight marks OR Can set one with four mark bits and one question with eight mark bits
3. Question Paper for First Test should be based on 40% of the curriculum of the subject and Second test on 40% of the remaining curriculum.

6.1.2 Sample Test Papers:

Sample Test Paper- 1

Roll No.				

17331

Institute Name:

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

Semester: **Third**

Subject**: Electrical Technology**

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

Instructions:

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

Q1. Attempt any three **09**

a) Define following terms for A.C.

i) Peak value ii) Average value iii) RMS value

b) State the effect of power factor on power consumption.

c) Find the value of resistors in Fig. Q1(c), if the equivalent resistance of three resistors joined in parallel is 12 Ω..

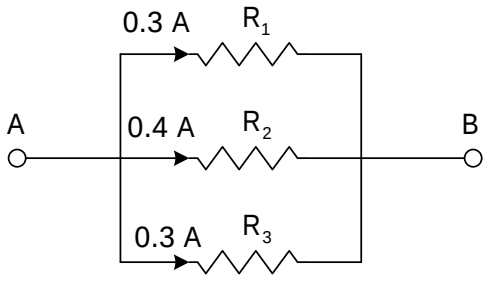


Fig. Q1(c)

d) Find the value of R_{12}, R_{23} and R_{31} in Fig. Q1(d).

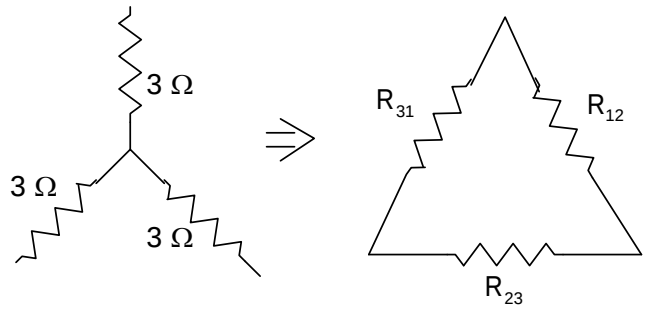


Fig. Q1(d)

Q2. Attempt any two **08**

a) State the following Laws:

i) Faraday's law of electromagnetic induction

ii) Len's law

b) Distinguish between statically induced EMF and dynamically induced EMF.

c) Show graphically following for A.C. quantities:

i) In phase quantity

ii) Lagging quantity

iii) Leading quantity

iv) Phase difference

Q3. Attempt any two **08**

a) Find the equation of current I when voltage of $v = .V_m \sin\omega t$ is applied to a pure inductive coil.

b) Define the following:

i) Active power

ii) Reactive Power

c) A series combination of a resistance and inductance when connected across 100 V d.c. supply dissipates 500 W of power. When connected across 100 V (r.m.s.) a.c. supply of frequency 50Hz, it dissipates 200 W of power. Calculate the values of resistance and inductance of the combination.

Sample Test Paper- 2

Roll No.				

17331

Institute Name:

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

Semester: **Third**

Subject**: Electrical Technology**

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

Instructions:

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

Q1. Attempt any three **09**

a) Distinguish between balance load and unbalance load. Give one example of each.

b) Give the following for delta connected balanced system:

i) Relation between phase and line current

ii) Relation between phase and line voltage

iii) Equation for three phase power

c) Draw a neat labeled diagram of pipe earthing as per IS.

d) State the factors on which severity of electric shock depends.

Q2. Attempt any two **08**

a) Define efficiency and voltage regulation of single phase transformer.

b) Give principle of operation and working of capacitor start single phase induction motor.

c) Give one application of the following single phase motors:

i) Resistance split phase motor

ii) Capacitor start motor

iii) Shaded pole motor

iv) Universal motor

Q3. Attempt any two **08**

a) Give construction and working principle of single phase transformer.

b) Give principle of operation and working of universal motor.

c) Compare Auto Transformer with two winding transformer on the basis of

i) Construction

ii) Cost

iii) Efficiency

iv) Application

Sample Question Paper

Exam Seat No.									

17331

Maharashtra State Board of Technical Education

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

Semester: **Third**

Title of the Subject**: Electrical Technology** Subject Code: **17331**

Marks**: 100** Time: **3 hrs**

Instructions:

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

Q1 (A) Attempt any SIX of the following. (12)

a) State Kirchhoff's Current law.

b) Give expression for the following:

i) Star to Delta conversion of resistances

ii) Delta to Star conversion of resistances

c) Define the following for a.c.:

i) Form Factor

ii) Peak Factor

d) State importance of Lenz's law.

e) State the difference between EMF and Potential Difference.

f) State two advantages of three phase circuits over single phase circuits.

g) Give classification of Fuses.

h) State two factors affecting severity of electric shock.

Q1 (B) Attempt any TWO of the following. **(08)**

a) Compare fuse and MCB on the basis of

i) Cost ii) operation iii) safety iv) service

b) State any one application of following single-phase motors:

i) Resistance split phase motor

ii) Capacitor start- induction run motor

iii) Shaded pole motor

iv) Universal motor

c) Draw a labeled diagram showing constructional details of core type single phase transformer. State its working principle.

Q2. Attempt any FOUR of the following. **(16)**

a) "In parallel combination, the equivalent resistance is less than the least among the resistors". Justify the statement with an example.

b) In Fig.2(b) 150 volts are applied to the terminal AB. Determine

i) the resistance between the terminal A and B

ii) the current I

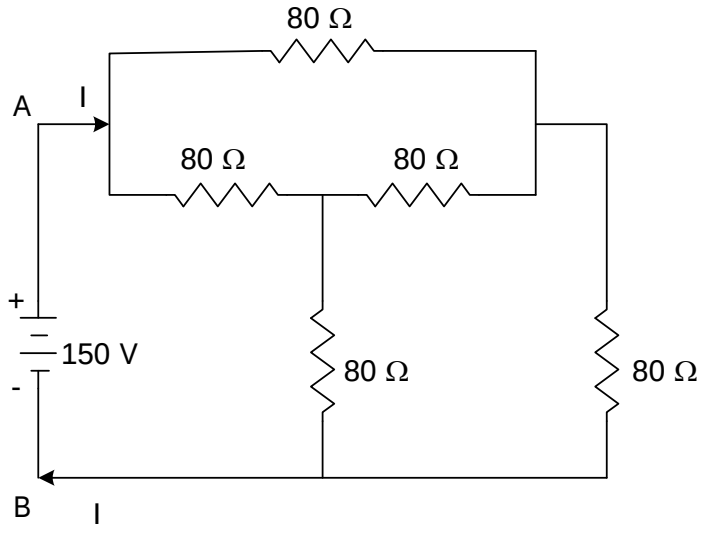


Fig.2 (b)

c) Write voltage equations for Fig.2(c) using Kirchhoff's voltage law.

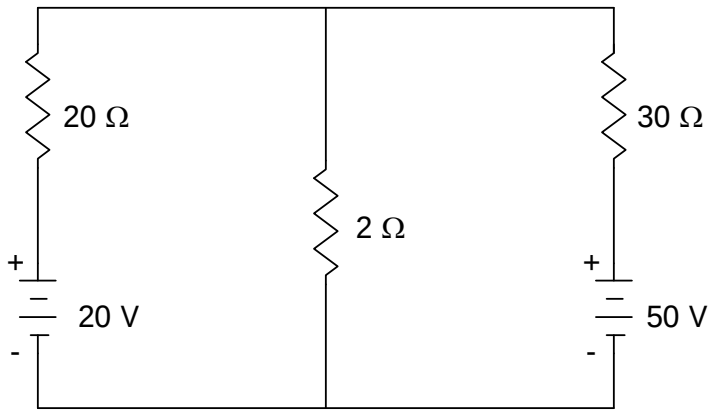


Fig.2(c)

d) Define the following related to a.c.

i) Frequency ii) Cycle iii) Time Period iv) Amplitude

e) Draw circuit diagram for measurement of single-phase power using dynamometer type wattmeter.

f) Define the following terms and state their expression:

i) Active Power

ii) Reactive Power

Q3. Attempt any FOUR of the following. (16)

a) Draw a.c. wave forms showing the following:

i) Phase difference

ii) In phase

iii) lagging

iv) leading

b) Find the Form Factor and Peak Factor of the sinusoidal alternating current.

c) Prove that average power consumption in pure inductor is zero when a.c. voltage is applied.

d) State Faraday's laws of electromagnetic induction.

e) Distinguish between statically induced EMF and dynamically induced EMF with example.

f) Draw phasor diagram for R-C series circuit. Write voltage and current equation for it.

Q4. Attempt any FOUR of the following. **(16)**

a) Explain the behaviour of a.c. circuit containing capacitor only when alternating voltage is applied across it.

b) In the circuit given in Fig 4(b) calculate current I by using series and parallel combination.

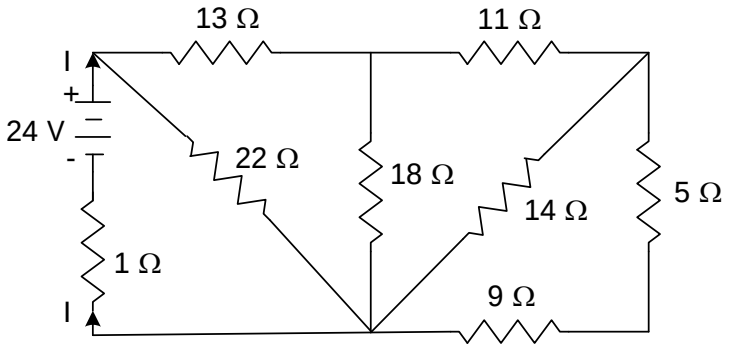


Fig 4(b)

c) Explain the effect of power factor on power consumption.

d) Distinguish between active and reactive power.

e) Compare auto transformer with two winding transformer on the basis of:

i) cost ii) construction iii) efficiency iv) application

f) Define voltage regulation and efficiency of single phase transformer.

Q5. Attempt any FOUR of the following. **(16)**

a) State relation between phase and line current and phase and line voltage of the following system:

i) Star connected balanced system

ii) Delta connected balanced system

b) Draw three phase a.c. wave forms. Explain phase sequence for the three phase a.c.

c) State advantages of balanced load in three phase system.

d) For a balanced three phase, three wire system with star connected load for which line voltage is 230V and per phase resistance and reactance is 6 ohms and 8 ohms respectively. Calculate line current and power absorbed by each phase.

e) An alternating current of frequency 50 Hz has a maximum value of 100 A. Calculate:

i) the instantaneous value after 1/360 second and

ii) the time taken to reach 80 A for the first time

f) Explain principle of operation of single phase induction motor.

Q6. Attempt any FOUR of the following. (16)

a) Voltage regulations of same capacity distribution transformers are 0.02 and 0.05 respectively. Which transformer will you choose? Justify your answer.

b) Give classification of transformers on the basis of :

i) construction ii) supply system ii) power rating iv) applications

c) A three-phase 400 V, 50Hz, a.c. supply is feeding a three phase delta connected load with each phase having a resistance of 25 ohms, an inductance of 0.15 H and a capacitance of 120 microfarads in series. Determine the line current and total three phase power absorbed.

d) A coil takes a current of 6 A when connected to a 24 V d.c. supply. To obtain the same current with a 50 Hz a.c. supply, the voltage required was 30 V. Calculate:

i) the inductance of the coil and

ii) the power factor of the coil

e) A circuit draws a current of 10 A at a voltage of 200 V and its power factor is 0.8 lagging. Calculate:

i) active power ii) reactive power iii) apparent power.

Also draw power triangle.
