2.6.2

Supporting Documents : Attainment of POs and COs are evalutated

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(Approved by AICTE & Affiliated to JNTUH)

COs- POs Mapping and Attainment Calculation

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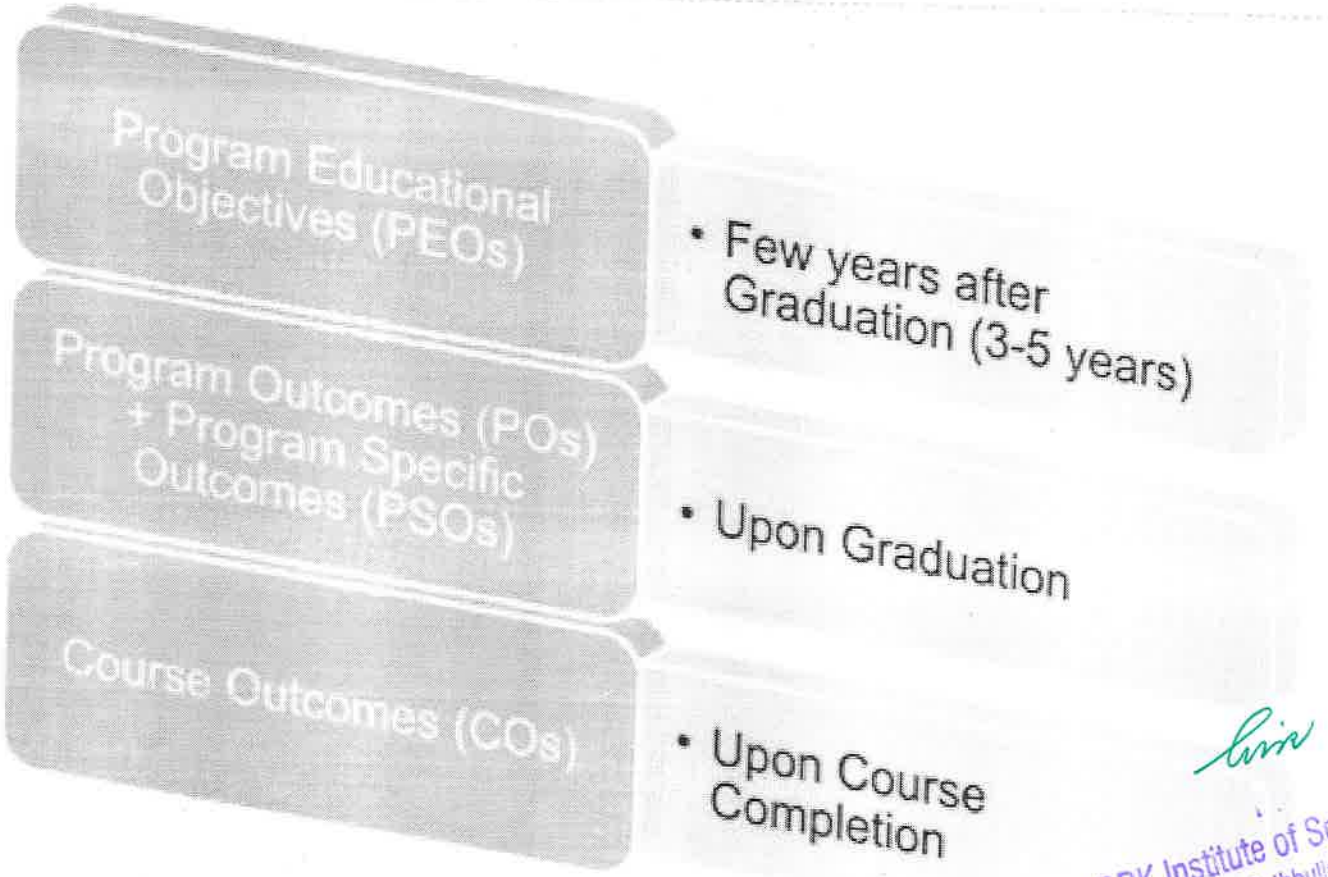
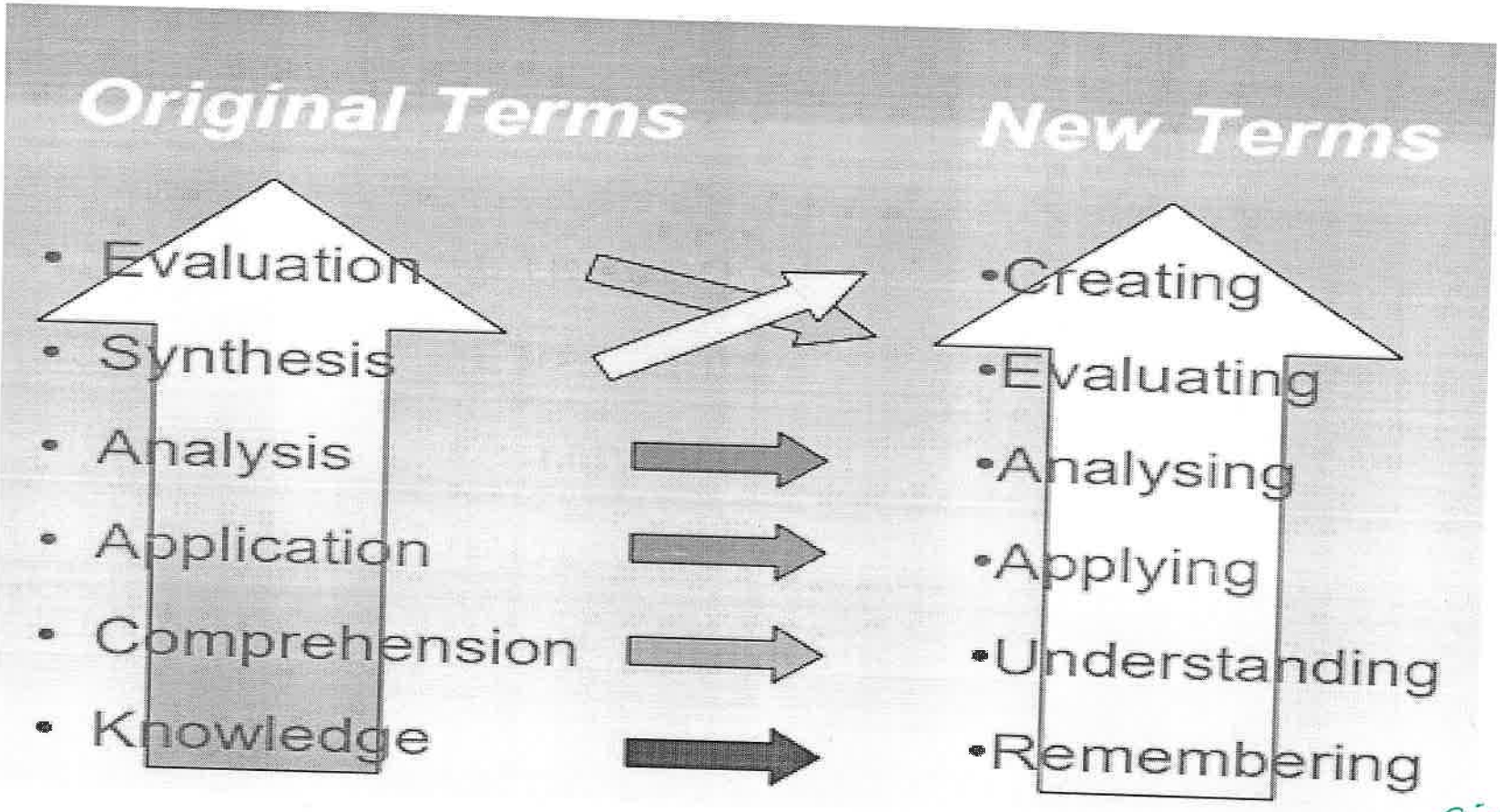
Presentation Outline

- Brief about CO's and Po's
- Preparing COs- POs Mapping
- Deciding Strength of Mapping of Course- PO's
- Calculating COs Attainment Calculating POs

When to assess?

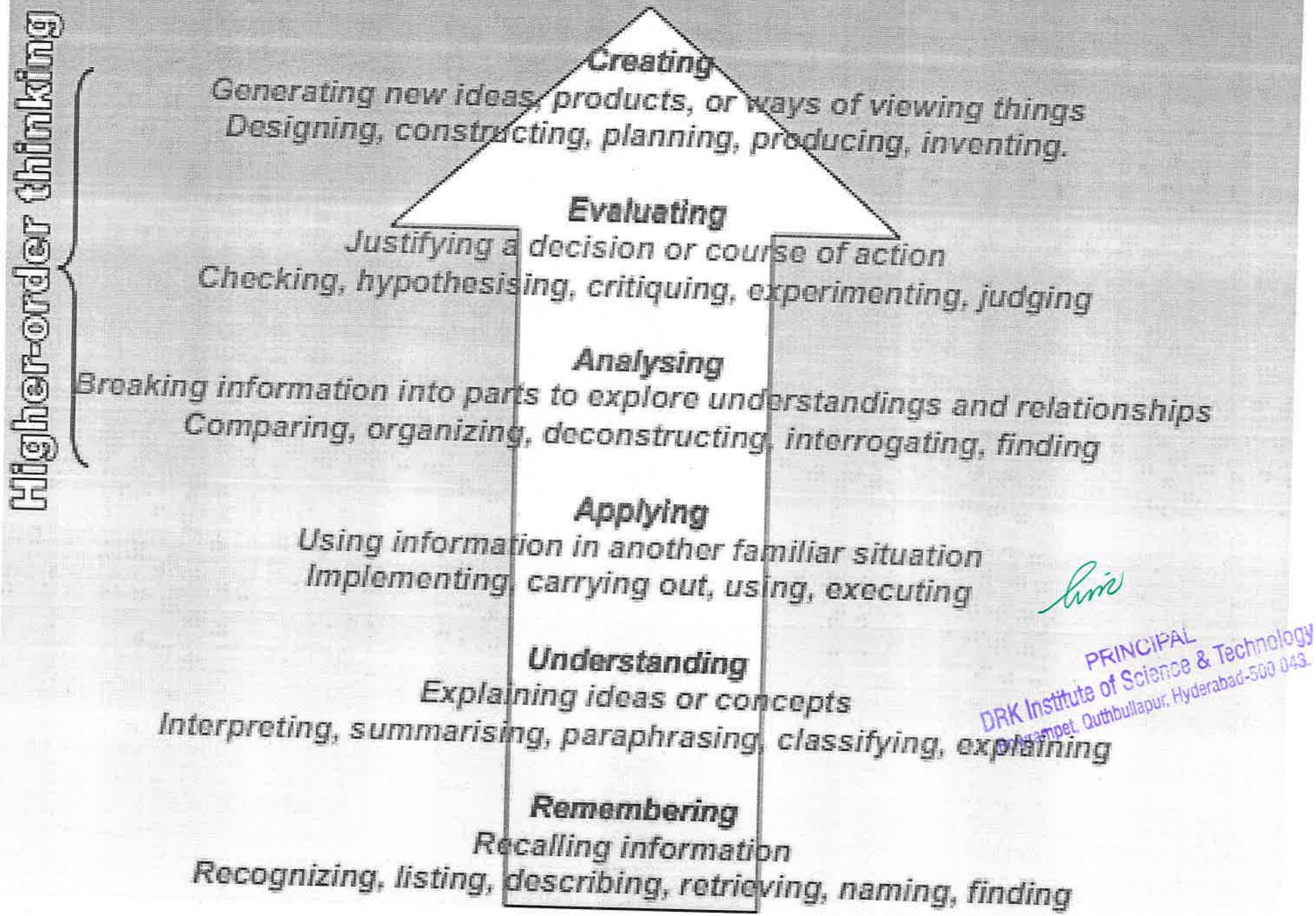


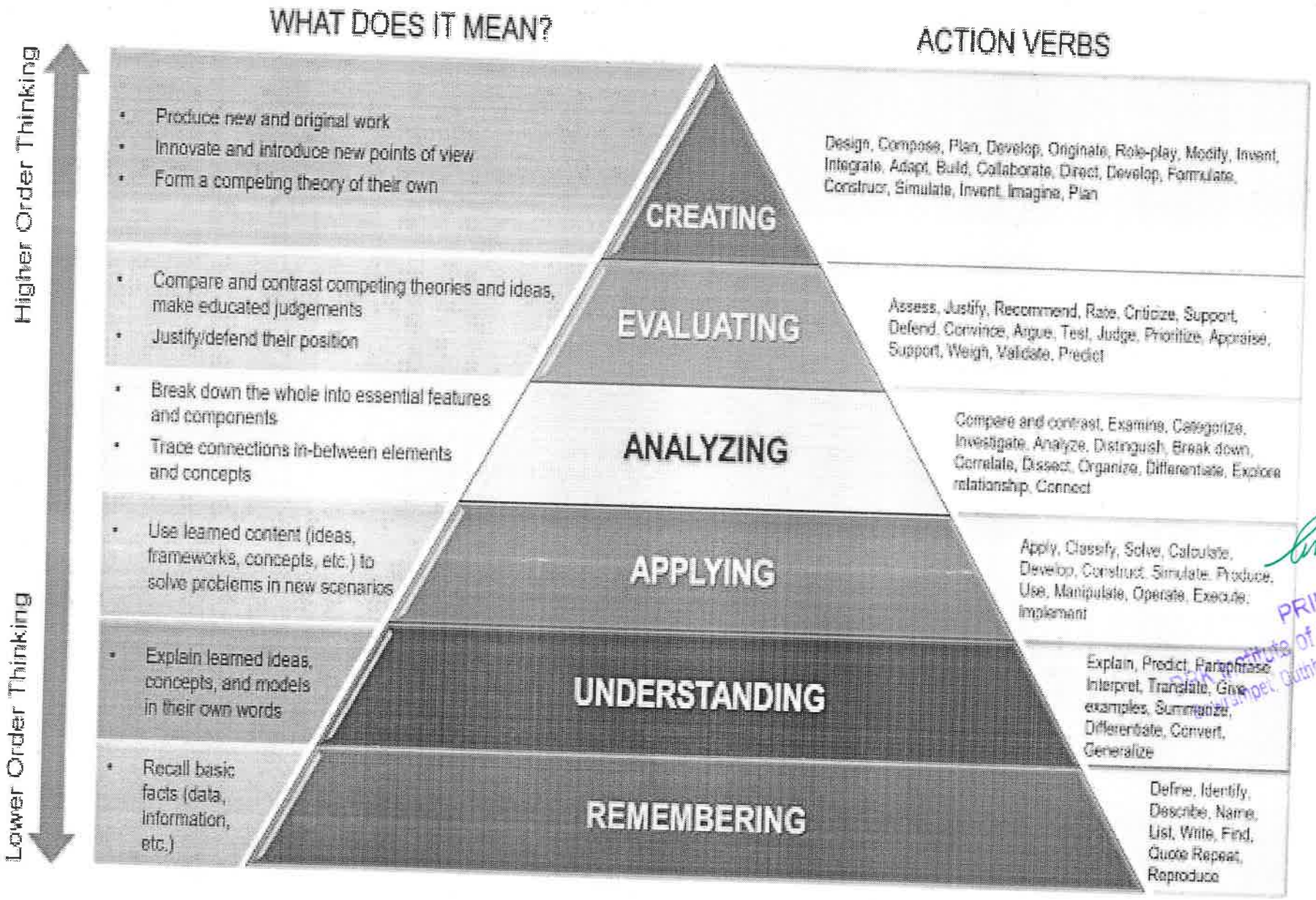
Revised Bloom's Taxonomy



The names of six major categories were changed from noun to verb forms.

BLOOM'S REVISED TAXONOMY





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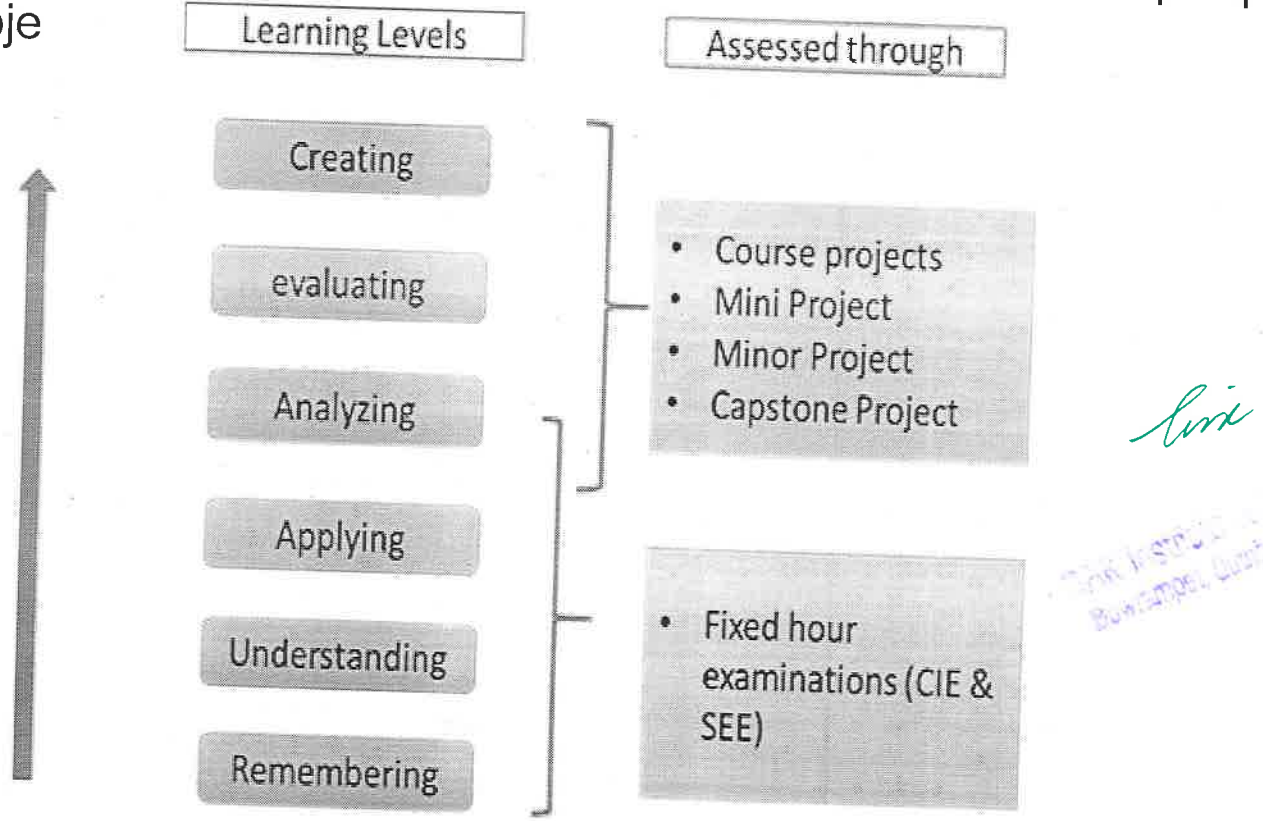
Assessment Planning

Normally the first three learning levels; remembering, understanding and applying and to some extent fourth level analyzing are assessed in the Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE), where students are given a limited amount of time. And abilities;

analysis, evaluation and creation can be assessed in extended course works or in a variety of student works like course projects, mini/ minor projects, internship experience and final year proje



Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in engineering education to structure the assessment as it characterizes complexity and higher-order abilities. It identifies six levels of competencies within the **cognitive domain** which are appropriate for the purposes of engineering education.

According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Remembering	Recalling from the memory of the previously learned material
2	Understanding	Explaining ideas or concepts (**in ones own words with rigour and precision**)
3	Applying	Using the information in another familiar situation (**ability to generalise and expand**)
4	Analysing	Decomposing a system/information into parts and connections between them to explore understandings and relationships
5	Evaluating	Justifying a decision or course of action (**Pros and ons reasoning**)
6	Creating	Generating new ideas, products or new ways of viewing things (**out-of-the box thinking**)

Action Verbs for Assessment

Choice of action verbs in constructing assessment questions is important to consider. Quite often, the action verbs are indicators of the complexity (level) of the question. Over time, educators have come up with a taxonomy of measurable verbs corresponding to each of the Bloom's cognitive levels.

These verbs help us not only to describe and classify observable knowledge, skills and abilities but also to frame the examination or assignment questions that are appropriate to the level we are trying to assess.

Suggestive list of skills/ competencies to be demonstrated at each of the Bloom's level and corresponding cues/ verbs for the examination/ test questions is given below:

Level	Skill Demonstrated	Question cues / Verbs for tests
1. Remember	Ability to recall facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria ability to recall methodology and procedures, abstractions, principles, and theories in the field knowledge of dates, events, places mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where

Level	Skill Demonstrated	Question cues / Verbs for tests
2. Understand	understanding information grasp meaning translate knowledge into new context interpret facts, compare, contrast order, group, infer causes predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
3. Apply	use information use methods, concepts, laws, theories in new situations solve problems using required skills or knowledge Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
4. Analyse	break down a complex problem into parts Identify the relationships and interaction between the different parts of a complex problem identify the missing information, sometimes the redundant information and the contradictory information, if any	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select

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Level	Skill Demonstrated	Question cues / Verbs for tests
5. Evaluate	compare and discriminate between ideas assess value of theories, presentations make choices based on reasoned argument verify value of evidence recognize subjectivity use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
6. Create	use old ideas to create new ones Combine parts to make (new) whole, generalize from given facts relate knowledge from several areas predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

It may be noted that some of the verbs in the above table are associated with multiple Bloom's Taxonomy levels. These verbs are actions that could apply to different activities. We need to keep in mind that it is the skill, action or activity we need students to demonstrate that will determine the contextual meaning of the verb used in the assessment question.

Sample questions for Bloom's Taxonomy levels

SAMPLES QUESTIONS FOR BLOOMS TAXONOMY LEVELS:

1. REMEMBER

Skill Demonstrated	Question Ques / Verbs for tests
Ability to recall of information like, facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria ability to recall methodology and procedures, abstractions, principles, and theories in the field knowledge of dates, events, places mastery of subject matter	list, define, describe, state, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.

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Sample Questions:

State Ohm's law

List the physical and chemical properties of silicon

List the components of A/D converter

List the arithmetic operators available in C in increasing order of precedence.

Define the purpose of a constructor.

Define the terms: Sensible heat, Latent heat and Total heat of evaporation

List the assembler directives.

Describe the process of galvanisation and tinning

Sample Questions:

9. Write truth table and symbol of AND, OR, NOT, XNOR gates

10. Define the terms: Stress, Working stress and Factor of safety.

11. What is the difference between declaration and definition of a variable/ function?

12. List the different storage class specifiers in C.

13. What is the use of local variables?

14. What is a pointer to a pointer?

15. What are the valid places for the keyword "break" to appear?

16. What is a self-referential structure?

2. UNDERSTAND

Skill Demonstrated	Question Ques / Verbs for tests
understanding information grasp meaning translate knowledge into new context interpret facts, compare, contrast order, group, infer causes predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss

Sample Questions:

Explain the importance of sustainability in Engineering design

Explain the behaviour of PN junction diode under different bias conditions

Describe the characteristics of SCR and transistor equivalent for a SCR

Explain the terms: Particle, Rigid body and Deformable body giving two examples for each.

Sample Questions:

5. How many values of the variable num must be used to completely test all branches of the following code fragment?

```
if (num>0)
 if (value<25)
{
value=10*num; if(num<12)
  value=value/10;
}
    else
 Value=20*num;
else
  Value=30*num
```

Discuss the effect of Make in India initiative on the Indian manufacturing Industry.

Summarise the importance of ethical code of conduct for engineering professionals

Explain the syntax for 'for loop'.

What is the difference between including the header file with-in angular braces < > and double quotes " "?

Sample Questions:

10. What is the meaning of base address of the array?
11. What is the difference between actual and formal parameters?
12. Explain the different ways of passing parameters to the functions.
13. Explain the use of comma operator (,).
14. Differentiate between entry and exit controlled loops.
15. How is an array different from linked list?

3. APPLY

Skill Demonstrated	Question Ques / Verbs for tests
use information use methods, concepts, laws, theories in new situations solve problems using required skills or knowledge Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify

Sample Questions:

Model and realize the following behaviors using diodes with minimum number of digital inputs.

- Turning on of a burglar alarm only during night time when the locker door is opened.
- Providing access to an account if either date of birth or registered mobile number or both are correct.
- Updating the parking slot empty light in the basement of a shopping mall.

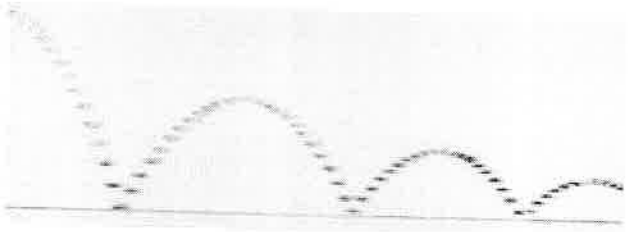
One of the resource persons needs to address a huge crowd (nearly 400 members) in the auditorium. A system is to be designed in such a way that everybody attending the session should be able to hear properly and clearly without any disturbance. Identify the suitable circuit to boost the voice signal and explain its functionality in brief.

Sample Questions:

3. A ladder 5.0 m long rests on a horizontal ground & leans against a smooth vertical wall at an angle 20^0 with the vertical. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder & the floor.

4. A ball is dropped from 6 meters above a flat surface. Each time the ball hits the surface after falling a distance h, it rebounds a distance rh. What will be the total distance the ball travels in each of the following cases.

(a) r>1 (b) 0<r<1 (c) r=1



The region bounded by the curves y=e^((-1)/x),y=0,x=1, and x=5 is rotated about the x-axis. Use Simpson's Rule with n=8 to estimate the volume of the resulting solid.

An electric train is powered by machine which takes the supply from 220 V DC rail running above the train throughout. Machine draws current of 100 A from the DC rail to account for high torque during starting and runs at 700 r.p.m initially. Calculate the new speed of the train once it picks up the speed where the torque output required is only 70% of starting torque. Assume the motor has a resistance of 0.1Ω across its terminals.

Sample Questions:

Write an algorithm to implement a stack using queue.

A single array A[1..MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables top1 and top2 (topl< top2) point to the location of the topmost element in each of the stacks. What is the condition for "stack full", if the space is to be used efficiently.

Consider the following table of arrival time and burst time for three processes P0, P1 and P2.

Process	Arrival Time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?

10. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look- aside buffer (TLB) which can hold a total of 128-page table entries and is 4-way set associative. What is the minimum size of the TLB tag?

4. ANALYZE

Skill Demonstrated	Question Ques / Verbs for tests
break down a complex problem into parts. Identify the relationships and interaction between the different parts of complex problem.	classify, outline, break down, categorize, analyse, diagram, illustrate, infer, select

Sample Questions:

A class of 10 students consists of 5 males and 5 females. We intend to train a model based on their past scores to predict the future score. The average score of females is 60 whereas that of male is 80. The overall average of the class is 70. Give two ways of predicting the score and analyse them for fitting model.

Suppose that we want to select between two prediction models, M1 and M2. We have performed 10 rounds of 10-fold cross-validation on each model, whereas the same data partitioning in round one is used for both M1 and M2. The error rates obtained for M1 are 30.5, 32.2, 20.7, 20.6, 31.0, 41.0, 27.7, 26.0, 21.5, 26.0. The

error rates for M2 are 22.4, 14.5, 22.4, 19.6, 20.7, 20.4, 22.1, 19.4, 16.2, 35.0. Comment on whether one model is significantly better than the other considering a significance level of 1%.

Sample Questions:

3. Return statement can only be used to return a single value. Can multiple values be returned from a function? Justify your answer.

4. Bob wrote a program using functions to find sum of two numbers whereas Alex wrote the statements to find the sum of two numbers in the main() function only. Which of the two methods is efficient in execution and why?

5. Carly wants to store the details of students studying in 1st year and later on wishes to retrieve the information about the students who score the highest marks in each subject. Specify the scenario where the data can be organized as a single 2-D array or as multiple 1-D arrays.

6. Dave is working on a Campus Management Software but is unable to identify the maximum number of students per course. He decided to implement the same using arrays but discovered that there is memory wastage due to over-provisioning. Which method of memory storage should be used by Dave and how it can be implemented using C?

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Sample Questions:

7. Ram is working on a 32-bit machine whereas Sita is working on a 64-bit machine. Both wrote the same code to find factorial of a number but Ram is unable to find factorial of a number till 9 whereas Sita is able to find the factorial of higher number. Identify the possible reason why Ram is unable to find the factorial. Suggest some changes in the code so that Ram can handle bigger inputs.

8. While writing a C code, the problem faced by the programmers is to find if the parenthesis is balanced or not. Write an algorithm to check if the parenthesis in C code are balanced. Initially your code should work for balanced { and } braces.

9. Swapping of the data in a linked list can be performed by swapping the contents in the linked list. Can the contents of a linked list be swapped without actually swapping the data?

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5. EVALUATE

Skill Demonstrated	Question Ques / Verbs for tests
compare and discriminate between ideas assess value of theories, presentations make choices based on reasoned argument verify value of evidence recognize subjectivity use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare; summarize, evaluate

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6. CREATE

Skill Demonstrated	Question Ques / Verbs for tests
use old ideas to create new ones Combine parts to make (new) whole, generalize from given facts relate knowledge from several areas predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

Both higher order cognitive skills 'Evaluate' and 'Create' are difficult to assess in time-limited examinations. These need to be assessed in variety of student works like projects, open ended problem- solving exercises etc. Typical examples of problem statements or need statements which need higher order abilities to solve are given below

Sample Problem / Need statements:

Automatic tethering of milking machine to the udder of a cow. A milk diary wants to automate the milking process. The milking process involves attaching the milking cups to the teats. Design a system for the same.

An electric vehicle uses LIoN batteries. The batteries have to be charged and get discharged during use. The batteries require continuous monitoring during charging and discharging so that they remain healthy and yield a long life. Design a system to monitor and manage the health of the batteries.

A Biotech industry needs automation for filling its product into 20 ltr bottles. Design a system to meter the flow into the bottles so that each bottle has 20 ltr of the liquid. There will be more than one filling station and the system has to monitor all the filling stations as well as keep count of the total production on a daily basis.

Microwave Doppler radar with a range of 9m are available for motion detection. Design a surround view monitoring system for a 3 wheeler to detect human obstacles while the vehicle is in motion.

Design a system to assist the driver by using cameras to detect lane markers and pedestrians while the vehicle is in motion.

Develop a small size USB 2.0 / 3.0 CMOS camera system which can be used for industrial inspection, medical applications, microscopy, etc. The system should be able to capture the image quickly and be able to process the captured image and then store it also

Program Outcomes

1. Engineering Knowledge
2. Problem Analysis
3. Design/development of solutions
4. Conduct investigations of complex Problems
5. Modern tool usage
6. The engineer and society
7. Environment and sustainability
8. Ethics
9. Individual and team work
10. Communication
11. Project management and finance
12. Life-long learning

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PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of **complex engineering problems.**

2. **Problem analysis:** Identify, formulate, review research literature, and analyze **complex engineering problems** reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for **complex engineering problems** and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological chang

CO-PO MAPPING

Steps for preparation of CO - PO attainment

Course Title: PROGRAMMING FOR PROBLEM SOLVING

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of the C programming language.
- To learn the usage of structured programming approaches in solving problems.

Course Outcomes: The student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in the C programming language.

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- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.
- Searching and sorting problems.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**		2									
CO2	**3**		2									
CO3	**3**											
CO4	**3**				2							
CO5	**3**	1										
CO6	**3**	**3**	**2**									

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Course Title: **DESIGN AND ANALYSIS OF ALGORITHM**

Course Objectives:

1. Introduces the notations for analysis of the performance of algorithms.

2. Introduces the data structure of disjoint sets.

3. Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic Programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate

4. Describes how to evaluate and compare different algorithms using worst-, average-, and best case analysis.

5. Explains the difference between tractable and intractable problems, and introduces the Problems that are P, NP and NP complete.

Course Outcomes:

1. Ability to analyze the performance of algorithms

2. Ability to choose appropriate data structures and algorithm design methods for a specified application

3. Ability to understand how the choice of data structures and the algorithm design methods Impact the performance of programs

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CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												

Course Title: Computer Networks

Course Objectives:

1. This course provides an insight into cloud computing
2. Topics covered include- distributed system models, different cloud service models, service-oriented architectures, cloud programming and software environments, resource management.

Course Outcomes:

1. Ability to understand various service delivery models of a cloud computing architecture.
2. Ability to understand the ways in which the cloud can be programmed and deployed.
3. Understanding cloud service providers.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		3								
CO2		1		2								
CO3			1	2	3							

Course Title: SIGNALS AND SYSTEMS

Course Objectives:

1. This gives the basics of Signals and Systems required for all Electrical Engineering related courses.
2. To understand the behavior of signal in time and frequency domain
3. To understand the characteristics of LTI systems
4. This gives concepts of Signals and Systems and its analysis using different transform techniques.

Course Outcomes: Upon completing this course, the student will be able to

1. Differentiate various signal functions.
2. Represent any arbitrary signal in time and frequency domain.
3. Understand the characteristics of linear time invariant systems.
4. Analyze the signals with different transform technique

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		2	1	2							
CO2	2		2	1	2							
CO3	2		3	3	2							
CO4	2		2	2	2							

Course Title: ANTENNAS AND PROPAGATION

Course Objectives: The course objectives are:

1. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
2. To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
3. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
4. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
5. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

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Course Outcomes: Upon completing this course, the student will be able to explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.

1. Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, UHF and Microwave antennas and also antenna arrays.
2. Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.

3. Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2		2							
CO2	2	1	2		2							
CO3	2	3	3		2							

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Course Title: EMBEDDED SYSTEM DESIGN

Course Objectives:

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

Course Outcomes: Upon completing this course, the student will be able to

1. To understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. To visualize the role of Real time Operating Systems in Embedded Systems.
4. To evaluate the Correlation between task synchronization and latency issues.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1								
CO2	2	2	2	1								
CO3	2	2	3	3								
CO4	2	2	2	2								

Course Title: ELECTRICAL CIRCUIT ANALYSIS

Course Objectives:

1. To understand Magnetic Circuits, Network Topology and Three phase circuits.
2. To analyze transients in Electrical systems.
3. To evaluate Network parameters of given Electrical network
4. To design basic filter configurations

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Apply network theorems for the analysis of electrical circuits.
2. Obtain the transient and steady-state response of electrical circuits.
3. Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
4. Analyze two port circuit behavior.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3										
CO3	3	3										
CO4	3	2										

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Course Title: POWER SYSTEM - I

Course Objectives:

1. To understand the different types of power generating stations.
2. To examine A.C. and D.C. distribution systems.
3. To understand and compare overhead line insulators and Insulated cables.
4. To illustrate the economic aspects of power generation and tariff methods.
5. To evaluate the transmission line parameters calculations
6. To understand the concept of corona

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the concepts of power systems.
2. Understand the operation of conventional generating stations and renewable sources of electrical power.
3. Evaluate the power tariff methods.
4. Determine the electrical circuit parameters of transmission lines
5. Understand the layout of substation and underground cables and corona.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2								
CO2	3	3	3	2								
CO3	3	3	3	2								
CO4	3	3	3	2								
CO5	3	3	3	2								

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Course Title: ELECTRICAL DISTRIBUTION SYSTEMS

Course Objectives:

1. To distinguish between transmission and distribution systems
2. To understand design considerations of feeders
3. To compute voltage drop and power loss in feeders
4. To understand protection of distribution systems
5. To examine the power factor improvement and voltage control

Course Outcomes: After completion of this course, the student able to

1. distinguish between transmission, and distribution line and design the feeders
2. compute power loss and voltage drop of the feeders
3. design protection of distribution systems
4. understand the importance of voltage control and power factor improvement

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2								
CO2	2	2	2	2								
CO3	2	2	3	2								
CO4	2	2	2	2								

Course Title: KINEMATICS OF MACHINERY

Course Objectives:

1. The objective is to study the relative motion, velocity, and accelerations of the various elements in a mechanism.
2. In mechanical Engineering we come across number of mechanisms such as four bar/slider crank/double slider crank/straight line motion mechanism etc.
3. Mechanism deals with only relative motions. Once we make a study considering for us also there it is called kinetics.
4. The first course deals with mechanisms, their inversions straight line motion mechanisms steering mechanisms etc. Also study of cams/gears & gear trains & belts are also introduced.

Course Outcomes: The main purpose is to give an idea about the relative motions obtained in all the above type of components used in mechanical Engineering.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2							

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Course Title: INSTRUMENTATION AND CONTROL SYSTEMS

Course Objectives:

1. Understanding the basic characteristic of a typical instrument.
2. Identifying errors and their types that would occur in an instrument.
3. Identifying properties used for evaluating the thermal systems.
4. The concept of transducer and Various types and their characters.

Course Outcome:

1. To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments.
2. Analysis of errors so as to determine correction factors for each instrument.
3. To understand static and dynamic characteristics of instrument and should be able to determine loading response time.
4. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3								
CO2	3	2	3	3								
CO3	3	2	3	3								
CO4	3	2	3	3								

Course Title: METROLOGY AND MACHINE TOOLS

Course Objectives: The course content enables students to:

1. Acquire the knowledge of Engineering metrology and its practice which is having increasing importance in industry.
2. Specifically make the student to improve applications aspect in the measurements and control of process of manufacture
3. Impart the fundamental aspects of the metal cutting principles and their application in studying the behavior of various machining processes.
4. Train in knowing the fundamental parts of various machine tools and their kinematic schemes.

Course Outcome: At the end of the course, the student would be able to

1. Identify techniques to minimize the errors in measurement.
2. Identify methods and devices for measurement of length, angle, gear & thread parameters, surface roughness and geometric features of parts.
3. Understand working of lathe, shaper, planer, drilling, milling and grinding machines.
4. Comprehend speed and feed mechanisms of machine tools.
5. Estimate machining times for machining operations on machine tools

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3	1									
CO3	3	3										
CO4	3	3										
CO5	3	3										

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