Points to be considered while writing the Course Outcomes

There should be alignment among the course outcomes, instruction and assessment.

Through instructions, students are facilitated to attain the course outcomes. The assessment should test whether the outcomes are attained or not.

Dos and Don'ts

- COs should be measurable or observable - Avoid using understand, know, appreciate etc. in the statements of COs
- Avoid using the word '**Derive"** while writing the course outcomes as it doesn't represent any cognitive thinking process.
- No. of course outcomes for a course: 4 to 6
- Should not be unit wise - Should consider the entire course while writing COs
- BTL should be considered while framing the COs
- All COs should not be at the same BTL level
- Don't write a single CO with multiple BTL levels. CO should be mapped to the highest BTL if it is mapping to multiple BTL levels.

  Example:

  1. Should be able to drive a car

  2. Should be able to identify accelerator and brake

  A person who is able to drive a car should be able to identify accelerator and brake – So the second CO is Not required
- POs also should be considered while writing COs - Depending on the BTL levels of COs, POs should be mapped . BTL of 3,4,5 and 6 get mapped to PO1, PO2, PO3 and PO4 respectively

Blooms Level of Course Outcome	Skill	Related PO
1, 2	Remember/ Understand	---
3	Apply	PO1
4	Analyze	PO2
5	Evaluate/ Investigate	PO4
6	Create/ Design	PO3

- Course outcomes shall be written to all courses including internship, Design thinking, projects, mandatory courses, lab courses
- COs should be written only for the course and not for any pre-requisite courses.
- A CO shall not be a sub-set of another CO. All COs should be independent.
- PO1 to PO5 represent the core competencies while PO6 to PO12 represent professional competencies.
- Every course normally gets mapped to 2 to 3 POs. Each CO should atleast map to one PO.
- A single CO normally gets mapped to one or two POs. CO should be mapped to only one PO from PO1 to PO4 - Map to the highest level. It can also be mapped to any other PO from PO6 to PO12.

Example: A person who studied Ph.d would definitely pass 10th class, Intermediate, B.Tech, and M.Tech before getting awarded the Ph.D degree. There is no need to mention about the other degrees. Mention the highest degree i.e) Ph.D

- While writing COs we need to consider the syllabus content, Teaching learning process and Assessment methods.

Proposed Format of a Course Outcome

Each CO should have a common Stem: At the end of the course students should be able to

Followed by an Action Verb: Represents Cognitive~~/ Affective/ Psychomotor~~ activity, the learner should perform. Only one action verb should be there for a CO. Occasionally two action verbs

Example: Prepare and Explain financial statement using fund flow and cash flow – Preparation is one activity and explanation is another activity

Followed by Knowledge: Specific knowledge from four/eight categories - General categories of knowledge -4 + Engineering categories - 4

Condition: The condition under which to perform the action (optional)

Criterion: Parameters that characterize the acceptability levels of performing the action (optional)

Examples:
At the end of the course students should be able to
1. **Design** a constant K low pass filter with a cut off frequency of 2 KHz.

2. **Write a program** to generate a periodic signal using MATLAB/ SCI lab software

3. **Determine** the value of $\sqrt{12}$ using Newton-Raphson method up to 4 decimal places.

Writing SMART course outcomes

SMART learning objectives are those that are specific (S), measurable (M), achievable (A), relevant (R), and timely (T).

At the end of the training program (on type writing)

Student should be able to Type 20 English words per minute - 500 words per minute (not achievable)

Electromagnetic Theory and Transmission lines

Old Course Outcomes	New Course Outcomes
At the end of the course, the student would be able to: CO1. Explain the concept of static electric and magnetic fields and their applications. CO2. **Derive** Maxwell's equations and explain their applications. CO3. Explain the concept of Electromagnetic wave and its propagation characteristics in different media. CO4. Explain the basic transmission line parameters and derive transmission line equations. CO5. Explain the transmission line applications as various circuit elements at RF and UHF.	At the end of the course, the student would be able to: CO1. Apply basic laws of electric and magnetic fields to solve problems related to different charge and current distributions. CO2. Analyze the applications of Maxwell's equations to time-harmonic fields, boundary conditions, and Poynting's theorem. CO3. Analyze the propagation characteristics of uniform plane waves in conducting and dielectric mediums. CO4. Analyze the characteristics of lossy and lossless transmission lines. CO5. Illustrate the applications of lossless transmission lines at RF and UHF frequencies

Antennas and Wave Propagation

Old Course Outcomes	New Course Outcomes
At the end of the course, the student would be able to: CO1. Explain radiation mechanism and various parameters of an antenna. CO2. Design Loop, Helical, Horn and Yagi–Uda antennas. CO3. Explain the working principle of Microstrip, Reflector and Lens antennas. CO4. Design different types of arrays and explain the test procedures involved in Antenna Measurements. CO5. Explain the mechanisms of wave propagation and atmospheric effects on radio wave propagation.	At the end of the course, student would be able to: CO1: Analyze the radiation mechanism in a current element, Microstrip, Reflector and Lens antennas. CO2: Deduce relationships among various antenna parameters. CO3: Design Loop, Folded dipole, Yagi-uda, Helical, and Horn antennas for the given specifications CO4: Analyze the radiation mechanism of Broad side, End fire and Binomial arrays CO5: Demonstrate the procedures for measurement of different antenna parameters CO6. Analyze various mechanisms of wave propagation and the atmospheric effects on radio wave propagation.

Representation of COs - Proposed Table

CO: At the end of the course students should be able to Analyze radiation mechanism of Broad side, End fire and Binomial arrays

Course Outcome	Action Verb (Skill)	BTL	Related PO	Teaching Methodology	Assessing Tools to measure CO
CO1	Analyze	4	2	Lecture	Mid exam, SEE, Assignment
CO2					
Assignment: Write a ‘C’ program for plotting the radiation pattern of a Broad side array with ‘n‘ (number of elements), ‘d’ (spacing between the elements) as variables.					