



INSTITUTE OF AERONAUTICAL ENGINEERING (AUTONOMOUS)

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AKANKSHA (Learning Management Portal)

Online Learning Resources for Students

IARE effectively provide learning resources digitally accessible to students and made sufficient to enable them to achieve the learning outcomes. Now let us explore what are the various types of online learning resources that are available in **IARE's AKANKSHA (Learning Management Portal)** for students.

1. Lecture Notes
2. Handouts
3. Early Learning Readiness Videos (ELRV) – Video Lessons
4. PowerPoint Presentation (PPT)
5. Definition and Terminology
6. Tech Talk Topics
7. Concept Videos
8. Open Ended Experiments
9. Question Bank
10. Model Question Papers

In addition, course materials include textbooks and all digital materials used for instruction in a course: digital books, online resources, digital media, journals, and magazines are available available in **IARE's AKASHA** (Library Information Service Portal). Digital resources can relieve financial strain. Because e-textbooks are generally cheaper than printed books, the usage of e-textbooks can provide a certain level of relief to the students worried about their rising academic expenses.

1. Lecture Notes

Large syllabi are condensed efficiently into written summaries, highlighting the most important information and omitting unnecessary details. Lecture notes provide key opportunities for students to learn about the subject they have chosen to study in an efficient way. Highly useful and efficient type of online learning resource for students is digital lecture notes.

This will help students familiarise themselves with the lecture material ahead of the class, provide an opportunity for preparatory background reading and prepare any questions that they may have. It also facilitates note-taking during the lectures by removing the need for students to copy down content from slides.

2. Handouts

Handouts can be an effective teaching tool whether they are professionally produced or simple, hand-lettered sheets. The student can then see clearly where the information fits in the overall picture. A handout can be of any size, depending on its purpose. Whatever its size, a well designed handout clarifies the topic being discussed and provides material beyond the lecture learning activities.

3. Early Learning Readiness Videos (ELRV) – Video Lessons

Students can better understand subjects through video lessons, which are frequently created or curated by teachers who teach in classroom or subject matter experts. These classes use animations, real-world examples, and demonstrations to make it easy for the learners to understand and comprehend the material. The students can learn at their own comfort and requirement for any where can access the content an unlimited number of times. That way whatever learning the learners gain stays with them for a long time.

4. PowerPoint Presentation (PPT)

The use of PowerPoint technology by faculty convey information contribute to students' learning more effectively compared with classes taught with chalk and board.

PowerPoint is an effective tool for presenting study materials. The use of PowerPoint technology by faculty convey information contribute to students' learning more effectively compared with classes taught with chalk and board.

Hence, it will help in the classroom and strengthen students' learning capacities. The use of supporting visuals like images, graphs, data-driven charts, and tables may pass better idea. Such visuals will help the viewer to get the idea effortlessly.

5. Definition and Terminology

5.1 Definition: A definition is a statement giving the meaning of a word or term.

In academic work students are often expected to give definitions of key term, word, concept, theory or in fact, any key issue/thing, where the meaning is uncommon or not really understood, just by reading it. Hence definition is needed. You neatly explain to make the meaning clear of what quality is to the reader through definition.

The course teacher is required to identify the key terms to define for study and then of course need to define them in your “Definition of Terminology” section. The idea of defining the key terms and major concepts of your study is to provide the reader with precise meanings of how you will be using them.

For your definitions, concision is key. Be brief and precise. Start your definitions with language such as, *self-efficacy is...* or *self-efficacy refers to...* This kind of sentence construction is expected and provides consistency among entries. Then, define the term, not generally, but *as you will be using it in your course*. If they are precise, definitions can be a sentence or two long. Usually, that is all you need.

Avoid using quotations in definitions, which is a good rule of thumb in academic writing generally. Paraphrasing is preferred. In something as short as a definition entry, there is no need to use quotes.

Let us now look at a simple definition: *A generator is a machine which converts mechanical energy into an electrical one.*

What is the term defined here? The term defined is 'generator'. When we define, we give information the class (C) to which the term (T) belongs and how it differs (Differentia-D) from other members of the class. Now let us examine the above definitions and find out the term, the class and the differentiating quality of the term.

<i>Term</i>	=	<i>generator</i>
<i>Class</i>	=	<i>machine</i>
<i>Differentia</i>	=	<i>converts mechanical energy into an electrical one.</i>

Let us now look at the language construction while writing definitions. A simple definition generally has the following components.

Term + verb + class + ‘wh’word + Differentia

For example, An ammeter is an instrument which is used to measure electric currents.

The above definition can be thus rewritten as: *An ammeter is an instrument for measuring electric currents.*

The terms (T) defined above is at the beginning of the sentence. But look at the definition, "Instruments for measuring temperatures are called thermometers". Here the term is placed at the end.

Sometimes it is difficult to define terms in a single sentence. It may have to be expanded. Definitions are expanded by using methods like, comparison and contrast, analogy, example, and derivation. Read the following expanded definitions and then we will find out the method used:

1. A diesel is similar in design to a conventional engine except that it is more heavily constructed to withstand extremely high compression. The high compression allows the diesel to operate on a much cheaper grade of hel than the type of lel used in a conventional engine.
2. An ecosystem is similar to a computer or any other mechanical device that has many intricate and related parts. If even the smallest component breaks down the machine will not function properly. So also the ecosystem is damaged by problems caused by humans.

(Adapted from: Technical writing : Principles and Forms by Deborah C. Andrews and Margaret D. Blickle, Macmillen publishing company (1982) P. 136)

In the first definition the diesel engine is compared with the conventional one and the diesel engines distinguishing features are brought out. Here the method used is comparison and contrast.

In the second definition also there is comparison. But ecosystem is defined by using the analogy of a machine (like computers). You will come across this type of expanded definitions in technical or scientific writing.

5.2 Terminology is a necessity for all professionals involved in the representation, expression, communication and teaching of specialized knowledge. Scientists, technicians or professionals in any field require terms to represent and express their knowledge to inform, transfer or buy and sell their products. Terminology plays an important role in the understanding of contexts and specialized texts.

5.3 Create effective Definitions and Terminology Library (DTL) for Computer Assisted Assessment (CAA)

What is Computer Assisted Assessment (CAA)?

Computer-Based Assessment (CBA) is assessment which is both delivered and marked by computer. Computer-based assessments are typically based on multiple choice questions (MCQs) or other 'objective' question types.

This distinguishes it from Computer Assisted Assessment (CAA), also known as e-Assessment or automated assessment, in which the computer is only used in *part* of the process of assessment. CAA as the application of computers to assessment processes, including delivery of tests, capture of responses and marking by either computer or human marker.

Why use CAA?

There are a number of benefits associated with the use of CAA. These include:

- Motivating and encouraging students to practice skills by providing opportunities for formative assessment
- Broadening the range of knowledge assessed (e.g. creating websites or complex diagrams) and extending the range of assessment methods (e.g. peer assessment, self-assessment)
- Offering opportunities for more immediate feedback, as well as allowing feedback to be delivered in different ways.

Depending on the CAA application, there may be additional advantages from an organisational point of view:

- Increasing objectivity and consistency, for example, standardising marks and feedback
- Aiding administrative efficiency.
- Implementing some of the above might require an extra investment of time and effort, even if savings are made in the long run. There might also be security issues, and an increased dependency on IT departments to adequately support hardware and software. Students may also need to be trained to use the CAA tool.

Why Use CAA for DT ?

CAA on Definitions and Terminology have the following reasons to use:

- To increase the frequency of assessment, thereby:
 - motivating students to learn
 - encouraging students to practise skills
- To broaden the range of knowledge assessed
- To increase feedback to students and lecturers
- To extend the range of assessment methods
- To increase objectivity and consistency
- To decrease marking loads
- To aid administrative efficiency

5.4 Guidelines for creating questions and answers for Definitions and Terminology Library (DTL) for CAA

There are some considerations to bear in mind, in creating questions and answers for DTL:

- Accurately recall facts, terminology and definitions.
- Present a single, definite statement to be completed or answered.
- These may not exceeding 2/3 lines.

- Avoid unnecessary and irrelevant material.
- Use clear, straightforward language in the stem of the item.
- Ability to recall facts and apply simple procedures in response to well-defined, pre-structured problems.
- Use negatives sparingly. If negatives must be used, capitalise, underscore, bolden or otherwise highlight.
- Put as much of the question in the stem as possible, rather than duplicating material in each of the options.
- Questions that are constructed using complex wording may become a test of reading comprehension rather than an assessment of whether the student knows the subject matter.

6. Tech Talk Topics

Engineering is considered a complex field. Due to this reason, course teacher plan presentations for the progressive learning of students. It is suggested to decide good presentation topics for engineering students in the course of study. A pre-decided topic can help improve confidence and develop enriched understanding. Moreover, students can pre-practice and keep track of their presentation time and progress.

Presentations are a way to research and learn from a topic. Good topic, content, and delivery are essential to communicate ideas better.

For example, Topics for Engineering Students (General)

1. Medical Uses of Nanotechnology
2. Turning Plastic Bags into High-Tech Materials
3. Money Pad Future Wallet
4. 6G Wireless Technology
5. Night Vision Technology
6. Air Pollution Monitor
7. ATM With an Eye
8. Bluetooth-Based Smart Sensor Networks
9. Energy-Efficient Turbo Systems
10. Laser Communication Systems

The selected topics shall be drawn from conferences, magazines, and IEEE letters which are practical applications from past FIVE years and gotten recognized for in the field which are useful to students. It helps students stay up-to-date in using technology and becoming better communicators in the workplace and at institute.

Guidelines to create impactful tech talk topic:

By following this procedure, faculty can construct a Tech Talk topic that is informative, engaging, and valuable content to enrich studies to students.

- Tech-Talk topics are needed to collect from articles written in- new concepts on a variety of technology topics which are more used in Microsoft, Google, Internet Graphics, Video, Social Media, etc., in recent and past five years.
- Tech-talk topics have current trends technology and origine of the concepts and its application in understanding the operation.

7. Concept Videos

For an engineering student, research and presentation become an integral part. Selecting for presentation by identifying concept oriented topics in the course of study by bringing the best, searching for something new, and presenting the same, is especially important. During the presentation, graphical communication of content is as important as physical or verbal.

Finding the best topics to research and presenting the same can bring new opportunities for student learning. For example, here are some interesting concept-oriented topics (general):

1. Storage area network for use is creating multiple data points and improving data security.
2. Thermal & Infrared Imaging Technology, its applications in industries, surveillance, construction, etc.
3. Traditional and 3D modelling used in films, computer graphics, gaming, interior design etc.
4. Aeronautical Communications for sharing data between aircraft and control centers. Communications such as aircraft-to-ground, aircraft-to-aircraft, and aircraft-to-satellite.
5. Performance Evaluation & EMI / EMC Testing of Energy Meter
6. Forming cheap and efficient low energy efficiency wireless network.
7. In contrast to object-oriented programming, how agent-oriented programming focuses on the construction of software.
8. 3D image technique and multimedia applications
9. Compressed Air Car - A car that can run not on any fuel, not on gasoline, but on air.
10. How Register Transfer Level (RTL) debugging can help find errors, and a need for the debugging to be automated when designs became complex.

8. Open Ended Experiments

Open-Ended Experiments (OEE) is a suitable method to measure student achievement in the practical skills and the psychomotor ability. It is also closely related to students' perception of their communication achievement throughout the course.

Integration of open ended experiments in teaching and learning approach is required, due to increasing use of emergent technologies in research and industry. As a result students could relate and use the knowledge learnt in each laboratory to complete the task.

Performing open ended experiments for laboratory courses gives freedom to develop their own experiments, instead of merely following the already set guidelines from a laboratory manual or elsewhere. It will create the students to think critically and also out of the box. The students here have to devise their own strategies and back them with explanations, theory and logical justification.

Implementing open ended experiments, increase the independent learning amongst students by giving them a platform to be innovative and creative in designing and executing their own experiments.

Open-ended experiments are exploratory research activities designed without a predetermined conclusion or specific hypothesis to be tested. Unlike traditional experiments, where the goal is to confirm or disprove a hypothesis, open-ended experiments aim to explore possibilities, generate new ideas, or understand phenomena more broadly.

To effectively implement OEE, the faculty needs to provide a list of innovative and creative OEE experiments. These should be designed and executed in a way that fully engages and prepares students.

9. Question Bank and Model Question Papers

Question Bank is suitable for end-of-lesson tests, revision activities or homework. Providing question banks and sample model question papers help students understand the test format and assess their strengths and weaknesses.

9.1 Question Writing Guidelines for Tutorial Question Bank

Question Bank is a kind of resource on each course in which a set of questions can be taken in any examination. Tutorial question bank comprises of three sections:

1. Section - A: Critical Thinking and Problem Solving
2. Section - B: Long Answer Questions
3. Section - C: Short Answer Questions

9.2 Designing Question Bank:

The purpose of this is to build up experience in writing questions, in order to test a wider range of student's thinking skills. All the questions developed in each of the three sections should be aligned for matching to Course Outcomes (COs) / Topic Learning Outcomes (TLOs). These include:

1. State the learning objective and note any verbs present in the way it is worded.
2. With reference to the verbs, match this to the appropriate level in Bloom's taxonomy.
3. Design a question to test the Course Outcomes / Topic Learning Outcomes.
4. Analyse the knowledge, skills and cognitive processing required in order to answer the question and identify appropriate verbs that describe this.
5. Match these to Bloom's taxonomy and check to see if the level of the question matches the learning objective.

9.3 The following guidelines are meant to help faculty about writing good quality questions:

Creating Critical Thinking and Problem Solving (CTPS) Questions:

Demonstrate decision making skills through critical thinking and problem solving skills using appropriate analytical framework, processes & quantitative techniques.

The questions related to critical thinking and problem solving skills, need demonstrate decision making skills through using appropriate analytical framework, processes and quantitative techniques.

For Example,

1. Discuss left skewed and right skewed binary tree. Construct an AVL tree by inserting the following elements in the order of their occurrence: 60, 2, 14, 22, 13, 111, 92, 86.
2. You could use an AVL tree to do a sort. Describe how you would do this. What is the worst-case running time for your sort?
3. Suppose we choose the median of five items as the pivot in quicksort. If we have an N element array, then we find the median of the elements located at the following positions: left (= 0), right (= $N - 1$), center (the average of left and right, rounded down), leftOfCenter (the average of left and center, rounded down), and rightOfCenter (the average of right and center, rounded down). The median of these elements is the pivot.

4. What is B-Tree? Write the various properties of B- Tree. Show the results of inserting the keys F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B in order into a empty B-Tree of order 5.
5. Kruskal's minimum spanning tree algorithm uses a heap to quickly find the lowest cost edge not already chosen. What would be the running time of the algorithm if instead of using a heap, the algorithm used a simple unsorted array to store the edges?

Creating Long Answer (LA) Questions

Long Answer (LA) questions also known as Written Response questions require respondents to write using multiple sentences, paragraph answers, or mathematical explanations and calculations. A long answer is supposed to be detailed, so make sure to create questions that allow students to write more.

Some important terms that can help you determine how to approach the LA question are:

- **Compare:** consider something in relation to something else (similarities, differences).
- **Define:** requires a detailed explanation of a term's meaning.
- **Describe:** write a representation of the concept.
- **Discuss:** demonstrate an understanding of facts that offers more than one point of view, perhaps favouring one point of view over the others.
- **Evaluate:** make critical comments backed by evidence, not merely opinion.
- **Identify:** answer includes who, what, where, when and why.
- **Relate:** apply knowledge to actual situations.

The answer needs to be read by the evaluator to provide a mark. Thus, this type of question cannot be automatically marked by computer assisted assessment by the system.

For example,

1. What is a priority queue? Explain the data structure known as a heap and describe how a heap can be implemented using a simple linear block of memory.
2. What difference can there be between the greatest and least lengths of paths from the root of the tree to a leaf?
3. Suppose we know the preorder and post order traversal sequences of a binary tree T
 - a. Suppose we know that all the non-leaf nodes of T have two children. Explain, using an algorithm, on how we can recover T from the two sequences. You need not explain the running time complexity of this algorithm.
 - b. Let the preorder traversal sequence of T be 100, 34, 16, 9, 8, 38, 11, 4, 81 and postorder traversal sequence be 34, 9, 11, 4, 38, 81, 8, 16, 100. If all the non-leaf nodes of T have two children, identify T.
4. Show how to implement a queue using two stacks. Analyze the running time of the queue operations.
 - a. Show that for a sequence of n queue operations, the implementation takes a worst case running time of $O(n)$.
 - b. If there are a maximum of k elements in the queue at a given time, what is the worst case running time to perform one queue operation?
5. Splay trees provide an adaptive mechanism for the representation of sets of character strings.
 - a. Outline the structure used by splay trees and briefly describe how the insert, lookup and delete operations work.
 - b. Discuss the advantages and disadvantages of using splay trees compared with the use of hash tables for the representation of sets of distinct character strings.

Short Answer (SA) Questions:

Short answer questions (SA) tend to be open-ended questions (in contrast to MCQ) and are designed to extract a direct response from students. SA can be used to check knowledge and understanding, support engagement with academic literature or a particular case study and to encourage a progressive form of learning.

They can be used in both formative and summative assessment. SA may take a range of different forms such as short descriptive or qualitative single sentence answers, diagrams or graphs with explanations, filling in missing words in a sentence, list of answers. As the name suggests, the answer is usually short.

For example,

1. Which data structure is used to perform recursion and why.
2. Define best case, average case and worst case for analysing the complexity of a program.
3. Differentiate between binary search tree and a heap.
4. Write the condition for empty and full circular queue.
5. What do you understand by tail recursion?
6. Construct an expression tree for the following algebraic expression: $(a - b)/((c*d)+e)$.
7. Differentiate between internal sorting and external sorting.
8. What are the advantages and disadvantages of array over linked list?
9. Write an algorithm for Breadth First Search (BFS) traversal of a graph.
10. In a complete binary tree if the number of nodes is 1000000. What will be the height of complete binary tree.