DAIICT

PC512 | Technical Writing and Communication Skills | Autumn 2022

In-Semester Examination 1

Closed Book

Total Marks 60

Time 2 Hours

Answer to each question should be written in 200-300 words. Marks would be deducted for spelling and grammatical mistakes.

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1. Read the essay given below and write a summary in your own words. [15]

The Nature of Mathematics

(These paragraphs are reprinted with permission from Everybody Counts: A Report to the Nation on the Future of Mathematics Education. ©1989 by the National Academy of Sciences. Courtesy of the National Academy Press, Washington, D.C.)

Mathematics reveals hidden patterns that help us understand the world around us. Now much more than arithmetic and geometry, mathematics today is a diverse discipline that deals with data, measurements, and observations from science; with inference, deduction, and proof; and with mathematical models of natural phenomena, of human behavior, and of social systems.

As a practical matter, mathematics is a science of pattern and order. Its domain is not molecules or cells, but numbers, chance, form, algorithms, and change. As a science of abstract objects, mathematics relies on logic rather than on observation as its standard of truth, yet employs observation, simulation, and even experimentation as means of discovering truth.

The special role of mathematics in education is a consequence of its universal applicability. The results of mathematics – theorems and theories – are both significant and useful; the best results are also elegant and deep. Through its theorems, mathematics offers science both a foundation of truth and a standard of certainty.

In addition to theorems and theories, mathematics offers distinctive modes of thought which are both versatile and powerful, including modeling, abstraction, optimization, logical analysis, inference from data, and use of symbols. Experience with mathematical modes of thought builds mathematical power – a capacity of mind of increasing value in this technological age that enables one to read critically, to identify fallacies, to detect bias, to assess risk, and to suggest alternatives. Mathematics empowers us to understand better the information-laden world in which we live.

During the first half of the twentieth century, mathematical growth was stimulated primarily by the power of abstraction and deduction, climaxing more than two centuries of effort to extract full benefit from the mathematical principles of physical science formulated by Isaac Newton. Now, as the century closes, the historic alliances of mathematics with science are expanding rapidly; the highly developed legacy of classical mathematical theory is being put to broad and often stunning use in a vast mathematical landscape.

Several particular events triggered periods of explosive growth. The Second World War forced development of many new and powerful methods of applied mathematics. Postwar government investment in mathematics, fueled by Sputnik, accelerated growth in both education and research. Then the development of electronic computing moved mathematics toward an algorithmic perspective even as it provided mathematicians with a powerful tool for exploring patterns and testing conjectures.

At the end of the nineteenth century, the axiomatization of mathematics on a foundation of logic and sets made possible grand theories of algebra, analysis, and topology whose synthesis dominated mathematics research and teaching for the first two thirds of the twentieth century. These traditional areas have now been supplemented by major developments in other mathematical sciences – in number theory, logic, statistics, operations research, probability, computation, geometry, and combinatorics.

In each of these subdisciplines, applications parallel theory. Even the most esoteric and abstract parts of mathematics – number theory and logic, for example – are now used routinely in applications (for example, in computer science and cryptography). Fifty years ago, the leading British mathematician G. H. Hardy could boast that number theory was the most pure and least useful part of mathematics. Today, Hardy's mathematics is studied as an essential prerequisite to many applications, including control of automated systems, data transmission from remote satellites, protection of financial records, and efficient algorithms for computation.

In 1960, at a time when theoretical physics was the central jewel in the crown of applied mathematics, Eugene Wigner wrote about the ``unreasonable effectiveness" of mathematics in the natural sciences: ``The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve." Theoretical physics has continued to adopt (and occasionally invent) increasingly abstract mathematical models as the foundation for current theories. For example, Lie groups and gauge theories – exotic expressions of symmetry – are fundamental tools in the physicist's search for a unified theory of force.

During this same period, however, striking applications of mathematics have emerged across the entire landscape of natural, behavioral, and social sciences. All advances in design, control, and efficiency of modern airliners depend on sophisticated mathematical models that simulate performance before prototypes are built. From medical technology (CAT scanners) to economic planning (input/output models of economic behavior), from genetics (decoding of DNA) to geology (locating oil reserves), mathematics has made an indelible imprint on every part of modern science, even as science itself has stimulated the growth of many branches of mathematics.

Applications of one part of mathematics to another – of geometry to analysis, of probability to number theory - provide renewed evidence of the fundamental unity of mathematics. Despite frequent connections among problems in science and mathematics, the constant discovery of new alliances retains a surprising degree of unpredictability and serendipity. Whether planned or unplanned, the cross-fertilization between science and mathematics in problems, theories, and concepts has rarely been greater than it is now, in this last quarter of the twentieth century.

2. Discuss the differences between a technical journal and a technical magazine. [15]

3. One of the seven “C“s of technical communication is “Coherence”. Explain. [15]

4. Why is reading important for developing skills in technical writing? Discuss. [15]

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In-Semester Examination 2

Closed Book

Total Marks 60

Time 2 Hours

Answer to each question should be written in 200-300 words. Marks would be deducted for spelling and grammatical mistakes.

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1. Discuss what you would write in the fourth chapter of your MTech/PhD thesis. [15]

2. Suppose you are an examiner of a thesis. What information about the research-work would you gather from the "References" mentioned in the thesis? [15]

3. Discuss three guidelines you would follow during an important technical presentation. [15]

4. Explain the statement "Technical communication is done for a well-defined gain". [15]

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End-Semester Examination

Closed Book

Total Marks 80

Time 2 Hours

Answer to each question from 1-4 should be written in less than 200 words. Do not exceed one page of the answer book for writing one answer.
Answer to each question should start from a fresh page.
Marks would be deducted for spelling and grammatical mistakes and for answers that do not follow the 7 C's of technical writing.

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1. Suppose your paper is selected in a conference for a poster presentation. Discuss the guidelines you would follow for preparing and delivering the presentation. [15]

2. Write the differences between an editorial review and an expert review of a document. [15]

3. Senior managers of your company held a meeting for discussing the budget and the general level of salary increase in the next financial year. You attended the meeting as a secretary. Write down the minutes of the meeting. [15]

4. Explain the differences between a research-paper and a research-proposal. [15]

5. Rewrite the text given below supplying the missing punctuation marks and capitalizations. [20]

> how can we determine the probability of our winning a game of solitaire (by solitaire we mean any one of the standard solitaire games played with an ordinary deck of 52 playing cards and with some fixed playing strategy) one possible approach is to start with the reasonable hypothesis that all (52)! possible arrangements of the deck of cards are equally likely to occur and then attempt to determine how many of these lead to a win unfortunately there does not appear to be any systematic method for determining the number of arrangements that lead to a win and as (52)! is a rather large number and the only way to determine whether a particular arrangement leads to a win seems to be by playing the game out it can be seen that this approach will not work in fact it might appear that the determination of the probability of winning at solitaire is mathematically intractable however all is not lost for probability falls not only within the realm of mathematics but also within the realm of applied science and as in all applied sciences experimentation is a valuable technique for our solitaire example experimentation takes the form of playing a large number of such games or better yet programming a computer to do so after playing say n games if we let

$$X_i = \begin{cases} 1 & \text{if the } i\text{th game results in a win} \\ 0 & \text{otherwise} \end{cases}$$

then X_i $i = 1 \ldots n$ will be independent bernoulli random variables for which

$$E[X_i] = P\{\text{win at solitaire}\}$$

hence by the strong law of large numbers we know that

$$\sum_{i=1}^{n} \frac{X_i}{n} = \frac{\text{number of games won}}{\text{number of games played}}$$

will with probability 1 converge to $P\{\text{win at solitaire}\}$ that is by playing a large number of games we can use the proportion of games won as an estimate of the probability of winning this method of empirically determining probabilities by means of experimentation is known as *simulation*