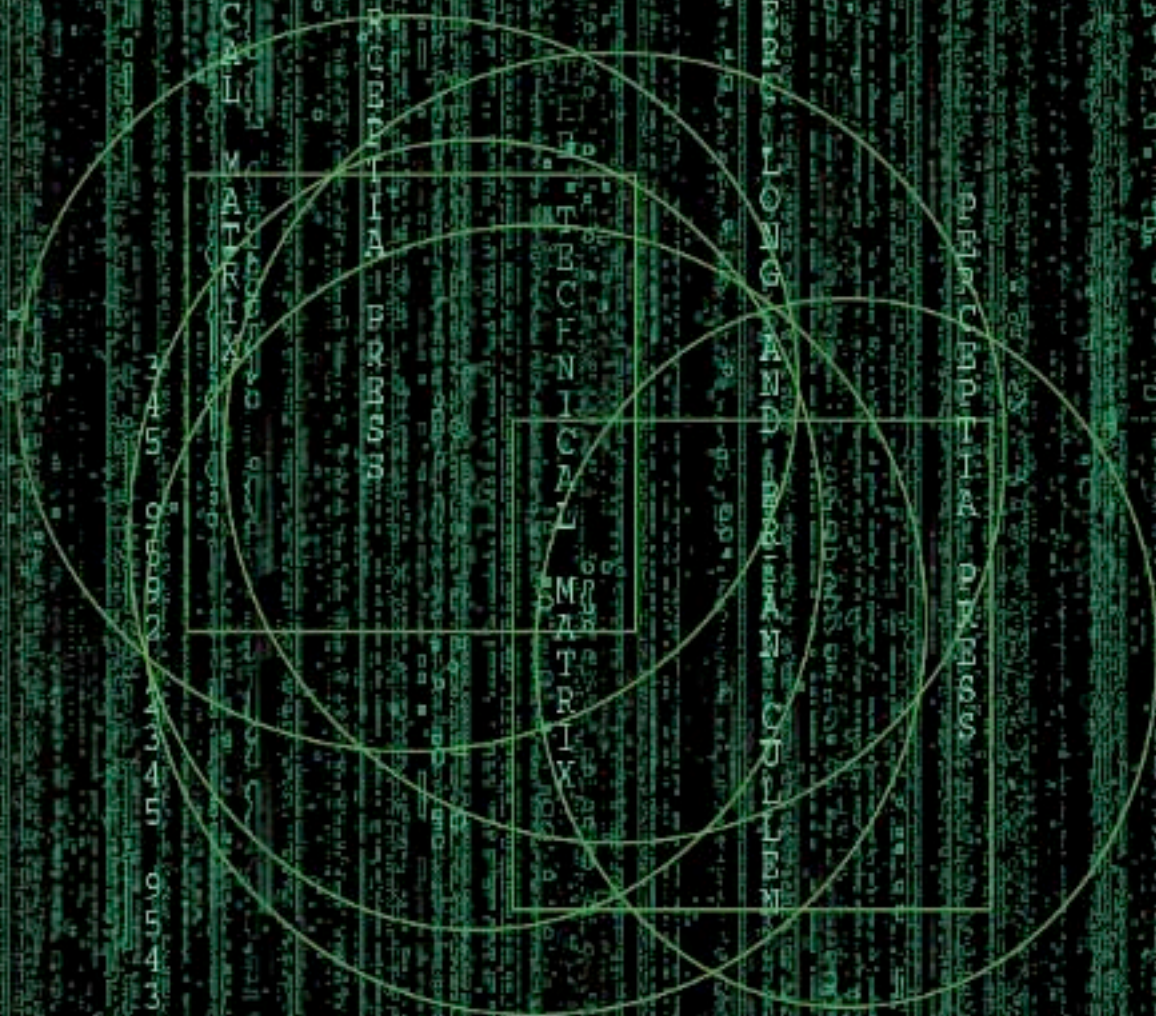


THE TECHNICAL MATRIX

Second Edition

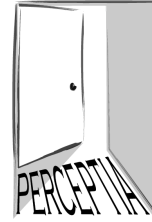


by Robert Long and Brian Cullen

Perceptia Press

Perceptia Press

Go ahead... open the door!



Thank You!

... for your interest in Perceptia Press. We are delighted to enclose the sample book(s) you requested.

We are teachers, too, and our goal is to produce textbooks that will help both you and your students have a rewarding learning experience. By aiming Perceptia Press books to be innovative and well-designed, we hope to open a door to a whole new level of learning in your classroom.

If there is any way we can help you reach a decision to use our textbooks, please get in touch. We are always happy to answer questions or provide more information. Just drop us a line at: info@perceptiapress.com or leave us a message on 03-4550-1292 and we'll get back to you very soon.

Best regards,

Brian Cullen
Paul Lewis

www.perceptiapress.com

The Technical Matrix

Robert W. Long III

Brian Cullen

Sample

PERCEPTIA PRESS

☁ NAGOYA ☁



2010

The Technical Matrix

©2010 Robert W. Long III and Brian Cullen and Perceptia Press

Published by Perceptia Press in association with Panurgic Publishing

Cover, design, and layout by Paul Lewis

Set in Gill Sans

All rights reserved. This book must not be copied or reproduced in any form whatsoever.

Printing 10 9 8 7 6 5 4 3

ISBN 4-939130-93-2

Notice of liability

Neither the authors nor the publisher shall have any liability to any person or entity with respect to any liability, loss, or damage caused or alleged to be caused directly or indirectly by any instructions, directions, or hardware or software products contained or described within this book.


About the authors

Robert Long is the foreign lecturer at Kyushu Institute of Technology. He teaches conversational and technical English, and has written various EFL textbooks. His homepage is: www.dhs.kyutech.ac.jp/~long/index.html.

Brian Cullen is an associate professor at Nagoya Institute of Technology. He teaches courses on scientific English, CALL, culture, and sound media. He has written many textbooks and released a number of music CDs. His homepage is: www.briancullen.net.

Acknowledgments

We would like to express our thanks to our students for helping us to pilot and refine this book. We are also grateful for the support of our colleagues at Kyushu Institute of Technology and Nagoya Institute of Technology. Some of the readings in this book are licensed under the GNU Free Documentation License. They are adapted from various *Wikipedia* articles. More information is available at: en.wikipedia.org/wiki/Wikipedia:Copyrights#Reusers.27_rights_and_obligations. Additional photos by: schoschie: molecule (p. 20); saschapohflepp: mechatronics lab (p. 22); Orin Optiglot: electrostatic machine (p. 24); Arenamontanus (p. 30); jeanbaptisteparis (p. 31); kayakaya (p. 33); USACE Europe District (p. 38); david.nikonvscanon (p. 42); skyfaller: resume face (p. 49); jurvetson: ant colony (p. 51); euthman (p. 62); Dardzi (p. 64); Erik Kilby: Fuel cell car (p. 80); phaul: Linux building (p. 81); caerdelyn (p. 85); Coweater (p. 94); huangjiahui (p. 96); Cazy89 (p. 103); Kallerna (p. 105).



Visit the
website for
more.

Foreword

The Technical Matrix is a textbook for engineering students who are studying English and want to learn some basic terms and ideas that are related to mechanical, chemical and civil engineering. The technical English that is presented is mostly based on material in Wikipedia, an Internet encyclopedia. Each chapter presents real-world information in the form of dialogues, readings or email exchanges. These are followed by comprehension tasks to help the students to understand the material and language tasks to enable them use the language in their own writing and speaking. The Technical Matrix provides ample material for one university semester or the activities can easily be adapted to suit a one year course. There are also additional materials available on the Perceptia Press website. These resources are indicated throughout the textbook with the icon *Visit the website for more*.

www.perceptiapress.com



	Focus	Core skills
Unit 1 7	Explaining your studies	Useful Skill: Mindmapping Presentation: Explaining your studies Language: Definitions & examples Which branch would you like to work in?
Unit 2 17	Companies in the field	Identify companies in your country and overseas What kind of work do they do? Examine their websites Useful skill: speaking from notes
Unit 3 27	People in the field	Famous people Professors at your university Useful language: Making questions Future role play Useful skill; speaking from notes (using a list) Presentation
Unit 4 37	Skills for engineers and developing them	Identify your skills and how you are improving them What changes do you foresee? Useful skill: Self-analysis Useful language: Expressing necessity and possibility
Unit 5 47	Applying for a job	Preparing a CV or resume Writing a CV A sample CV
Unit 6 57	Scientific papers	A short history of the scientific paper Understanding scientific papers Identifying important journals A sample scientific paper
Unit 7 69	Improving your company	Improving your company The engineer as entrepreneur
Unit 8 79	Writing a laboratory report	Useful Language; Describing methods with objective language Useful skill: Making graphs Writing an experiment report
Unit 9 89	Writing product descriptions and manuals	Understanding product descriptions Writing a product description Understanding manuals Writing instructions
Unit 10 99	Towards writing scientific papers	Your interests Research topics in your laboratory or university Looking to the literature Identify your research topic

	Chemical engineering	Network engineering	Mechanical engineering	Civil engineering	Electrical engineering	
	Corrosion	Local area networks	Fluid mechanics	Structural analysis	Electrical resistance	Unit 1 7
	Bonding	Peer-to-peer networking	Mechatronics	Seismic engineering	Electrostatics	Unit 2 17
	Radiochemistry	Zigbee	Pneumatics	Dams	Electric networks	Unit 3 27
	Ceramics	Wireless mesh networks	Solar energy	Bridges	Digital circuits	Unit 4 37
	Acids	Ant colony optimization	Automatic systems	Reservoirs	Transformers	Unit 5 47
	Absorption	Software engineering	Nanotechnology	Surveying	Telecommunications	Unit 6 57
	Analytical chemistry	Computer architecture	Drafting	Fire protection engineering	Voltage	Unit 7 69
	Catalysis	Operating systems	Piping	Geotechnical engineering	Electronics	Unit 8 79
	Chemical kinetics	Cryptography	Seals & fittings	Transport engineering	Microelectronics	Unit 9 89
	Chemical reactions	Artificial intelligence	Structural failure analysis	Environmental engineering	Signal processing	Unit 10 99

Student engineering word list

This list contains 100 of the most frequently used words in engineering texts as determined by Olga Moudraia of Lancaster University. These words can be used in many different ways, so be sure to look for example sentences in your dictionary and texts. Ten of these words are targeted in each unit of this textbook.

- | | |
|------------------------|---------------------|
| 1. act/ react | 51. load |
| 2. air / aero- | 52. low |
| 3. all | 53. machine |
| 4. also | 54. make |
| 5. angle | 55. mass |
| 6. apply | 56. material |
| 7. area | 57. maximum |
| 8. assume | 58. metal |
| 9. axis | 59. method |
| 10. base / basic | 60. moment |
| 11. beam | 61. move / remove |
| 12. body | 62. number |
| 13. calculate | 63. obtain |
| 14. case | 64. other / another |
| 15. center | 65. part |
| 16. change | 66. pipe |
| 17. chapter | 67. placement |
| 18. component | 68. plane |
| 19. consider | 69. point |
| 20. constant | 70. position |
| 21. cut | 71. pressure |
| 22. define | 72. problem |
| 23. design | 73. process |
| 24. determine | 74. produce |
| 25. diameter | 75. put |
| 26. different | 76. require |
| 27. dimension | 77. result |
| 28. direction | 78. rotate |
| 29. draw | 79. section |
| 30. element | 80. shear |
| 31. end | 81. show |
| 32. energy | 82. solution |
| 33. equation | 83. state |
| 34. equilibrium | 84. steel |
| 35. example | 85. stress |
| 36. expression | 86. structure |
| 37. figure / configure | 87. surface |
| 38. find | 88. system |
| 39. flow | 89. temperature |
| 40. fluid | 90. time |
| 41. follow | 91. type |
| 42. force | 92. unit |
| 43. form | 93. use |
| 44. free | 94. value |
| 45. friction | 95. vary |
| 46. give | 96. velocity |
| 47. high | 97. view |
| 48. know | 98. water |
| 49. length / long | 99. work |
| 50. line | 100. write |

Sample



Explaining your studies

Chemical engineering p. 10	Corrosion
Network engineering p. 11	Local area networks
Mechanical engineering p. 12	Fluid mechanics
Civil engineering p. 13	Structural analysis
Electrical engineering p. 14	Electrical resistance

Self-introduction and background

1. What is your name, and what branch of engineering are you studying?
2. How did you become interested in this area?
3. What are some common topics that you have to know in this area of engineering?

Specific questions

4. What particular things are you learning now?
5. What is your most interesting subject?
6. What kinds of classes are you now taking?
7. Which class will be the most difficult?

Today's readings

8. What do you know about the reading topic (choose the topic for your specialization on pages 10-14)?
9. Do you think this topic is fairly important?
10. What do you think is the most important topic in your field now?

Other fields of engineering

11. How much do you know about chemical engineering?
12. Have you read much about civil or electrical engineering?
13. Which branch of engineering do you think is the most difficult?
14. Have you talked to any engineers who are now working? What have they told you?

Here's a useful tip—If you don't know much about the topic of a reading in this textbook, you can look it up in your own language on Wikipedia or another website. That will help you to understand the English much better.

Explaining your studies

There are many types of engineering. See how many you can add to this list:

Civil engineering

Mechanical engineering

Electronic engineering

.....

.....

.....

.....

.....

Any of these types of engineering can be sub-divided further. It is important to know of the many sub-disciplines in your field of engineering, and of the many areas and interests that are in each sub-discipline. Ask your professors, or use the Internet to find out about your own area of engineering. Fill in as much information as you can.

My branch of engineering:

Sub-discipline	Topics of interest

Visit the
website for
more.

Useful language: Definitions

We use definitions frequently in science and engineering. Why do we do this? In everyday speech, it is not important if two people do not use a word to mean exactly the same thing. But in engineering, it can be a huge problem.

Here are some examples of definitions of engineers.

- A civil engineer is a person who designs or supervises construction projects such as roads or dams.
- A chemical engineer is a person who applies the principles of chemistry to solve problems in areas such as manufacturing products and regulating water supply.

Write more definitions for different kinds of engineer.

Definitions: Define your subjects

Here are some definitions of subjects studied in engineering schools.

- Fluid mechanics is the study of the movement of fluids. One application of fluid mechanics is in controlling the flow of liquid in pumps and refrigerators.
- Materials Science is based on the physics and chemistry of the solid state and includes all aspects of engineering materials, including metals and their alloys, ceramic materials such as glasses, bricks, and porcelain insulators, polymers such as plastics and rubbers together with semiconducting and composite material. Material science is important because it helps us to design stronger and safer materials.

Define your subjects using similar language.

Sample

Presentation: Explaining your studies

When you make a presentation, organizing your ideas is very important. Choose one engineering subject that you are studying now or have studied in the past. Then write four sentences about this. Every presentation usually follows a standard format. You need a beginning, a middle, and an end.

Beginning

Good morning everyone. Today I would like to talk about

Middle

..... really interests me because
In this subject, we learn about
..... These are important because

End

Thank you. Do you have any questions?

Useful Language

My favorite subject is... because...
I really respect Professor... because...
In the future, I would like to...

Make your presentation to the members of your class or group.

I >> CORROSION

Specialized vocabulary

Check that you understand the following words and phrases which appear in the text.

applied coating	crystallites	exposure	pit
bacteria	deterioration	fundamental nature	polymer
boundary	discoloration	intrinsic properties	reaction
chemoautotrophs	dissolution	microorganism	substance
crack	electrochemical	oxidation	ultraviolet light

Dialogue 1: Definition

- Sam: Excuse me, professor. Could you help me out for a minute?
- Technician: Sure. Ah, I see you're working on Professor Suzuki's lecture on corrosion. It's difficult!
- Sam: Yes, there are some parts I don't understand. To begin with, how would you define *corrosion*?
- Technician: Corrosion is the deterioration of intrinsic properties in a material due to reactions with its environment.
- Sam: Could you give an example?
- Technician: Sure. One common example of electrochemical corrosion is the weakening of steel due to oxidation of the iron atoms. This type of damage usually affects metallic materials, and typically produces oxides or salts of the original metal.
- Sam: What does "deterioration of intrinsic properties" mean?
- Technician: It means a weakening of the properties within the material or metal. Corrosion also includes the dissolution of ceramic materials and discoloration and weakening of polymers by the sun's ultraviolet light.
- Sam: In the lecture, the professor said that most alloys corrode merely from exposure to moisture in the air.
- Technician: Well that's true, but the process can also be strongly affected by exposure to certain substances.
- Sam: Does corrosion usually affect the entire surface of a metal?
- Technician: It can be concentrated locally to form a pit or crack, or it can extend across a wide area to produce general deterioration.



Dialogue 2: Kinds of corrosion

- Sam: Could you explain intergranular corrosion?
- Technician: Intergranular corrosion or IGC is where the boundaries of crystallites of a material are more susceptible to corrosion than their insides. In contrast, pitting corrosion, or pitting, is extremely localized corrosion that leads to small holes in the metal.
- Sam: Are there any other kinds of important corrosion that I should know about?
- Technician: Another kind is called microbial or bacterial corrosion. This is caused by microorganisms and can affect both metals and non-metallic materials.

Dialogue 3: Resistance to corrosion

- Sam: Thanks. That's very helpful. One last thing.
- Technician: Sure. I'm happy to help out.
- Sam: With regard to corrosion, are there differences between metals?
- Technician: Of course! Some metals are more resistant to corrosion than others, either due to the fundamental nature of the electrochemical processes involved or how a particular effect could form on that material.
- Sam: Are there any ways to stop corrosion?
- Technician: Yes. The most common anti-corrosion treatments are applied coatings such as plating, painting, and applying enamel. These work by providing a barrier of corrosion-resistant material between the damaging environment and the structural material.

Check that you understand the following words and phrases which appear in the text.

Dialogue 1: What is a LAN?

Paul: Yes, it's a bit of a mess. I hope some proper standards emerge eventually.

Professor: I'm not sure about that, but you certainly remember your stuff!

Paul: It has been standardized as IEEE 802.3 which means the Institute of Electrical and Electronics Engineers or IEEE (pronounced as eye-triple-e).

application	fluids	moment	shear stress
deformation	gas	Newtonian fluid	static equilibrium
density	ideal fluid	petroleum	subdiscipline
derivative	internal resistance	pipeline	velocity
empirical	isotropic	plasticity	viscosity
to establish	liquid	rheology	weather patterns



Specialized vocabulary

Check that you understand the following words and phrases which appear in the text.

algebra	to derive	geometry	stiffness
assembly	differential equation	internal force	stress
cantilever	elasticity	linear	structural analysis
component	evaluation	methods of analysis	structural load
deflection	finite element	node	support conditions
deformation	flexibility	portal frame	truss

Dialogue 1: Structural analysis

Professor: Okay, Larry, let's see how much you remember. What is meant by structural analysis?

Larry: Structural analysis is the computation of deformations, deflections, and internal forces or stresses within structures, either for design or for performance evaluation of existing structures.

Professor: Good answer! But what kind of data needs to be gathered to carry out a structural analysis?

Larry: Structural analysis needs data such as structural loads, the structure's geometry and support conditions, and the materials' properties.

Dialogue 2: Methods of analysis

Professor: Now, let's move on to methods of analysis. Can you tell me about this area?

Larry: The method of mechanics of materials is limited to very simple structural elements under relatively simple loading conditions.

Professor: So, in conjunction with the methods of analysis, what field would you use to analyze entire systems?

Larry: It can be used in conjunction with statics for joints for truss analysis, moment distribution for small rigid frames, and portal frame and cantilever method for large rigid frames.

Dialogue 3: Finite element methods

Professor: Can you explain finite element methods?

Larry: They model a structure as an assembly of elements or components connected in various ways. Thus, a continuous system such as a plate or shell is modeled as a discrete system with a finite number of elements interconnected at a finite number of nodes.

Professor: Then, how can we establish an element's stiffness or flexibility relation?

Larry: To do this, we can use the elasticity approach for more complex two- and three-dimensional elements. The analytical and computational development are best carried out by matrix algebra.

Dialogue 4: Elasticity methods

Professor: I need you to tell me more about elasticity methods. What do you know?

Larry: They are generally available for an elastic solid of any shape. The solutions are derived from the equations of linear elasticity, a system of 15 partial differential equations.

Professor: Good work.

Check that you understand the following words and phrases which appear in the text.

Email message 1: What is electrical resistance?

Email message 2: Resistance in metals

Email message 3: Differential resistance

14

Reading tasks

1. Based on your reading, answer the questions in the table.

	Questions	Expressions
Chemical engineering	1. What is IGC? 2. What does pitting corrosion cause? 3. What can be applied to a material to reduce corrosion? 4. What causes microbial or bacterial corrosion? 5. Why do metals differ in their resistance to corrosion?	<ul style="list-style-type: none"> ● I see you're working on... ● One common example of... ● With regard to...
Network engineering	1. Where are you likely to find LAN systems? 2. How big is a LAN party? 3. Are LAN parties permanent? 4. What is the standard for ethernet? 5. Define <i>ethernet</i> .	<ul style="list-style-type: none"> ● ... defining characteristics... ● In reality,... ● ... come in various sizes...
Mechanical engineering	1. What are some of the applications of fluid mechanics? 2. What is one of the tasks of rheology? 3. What is involved in the solution of a fluid dynamics problem? 4. How do fluids exert pressure? 5. What is rheology?	<ul style="list-style-type: none"> ● One of the tasks of... ● ... under the influence of... ● ... is commonly perceived as...
Civil engineering	1. What is structural analysis? 2. How is the method of mechanics of materials limited? 3. What does the finite element model do? 4. What kind of input data does structural analysis need? 5. What are the equations of linear elasticity?	<ul style="list-style-type: none"> ● To do this,... ● In conjunction with... ● ... are derived from...
Electrical engineering	1. What happens when a voltage is applied across the metal? 2. What is the SI unit of electrical resistance? 3. For any given voltage, what does the quantity of resistance determine? 4. What does a metal consist of? 5. What is the main reason for the scattering of electrons?	<ul style="list-style-type: none"> ● ... is a measure of... ● ... I realized that... ● It is very important to know...

2. Write two of your own questions based on the information in the text. Test your classmates.

.....

.....

3. Find and underline the expressions in the readings. Use each expression in your own original sentence.

Digging deeper

Look back at the readings and write two questions that you would like the text to have answered.

.....

.....

Ask your classmates if they know the answers. Search the Internet if necessary.

Visit the
website for
more.

Explaining your topic

In your notebook, make notes or a mindmap to represent the important information in the reading. If possible, find someone who is studying a different engineering major. Take turns using your mindmaps to explain what you learned in the reading. Make notes below on what you learned from your partner.

Discuss with a partner:

- Was this topic interesting?
- How much of this information did you already know?
- Do you think this topic is important? Why or why not?

Talking points

Research one of these topics on the Internet. Make notes and then talk about it for two minutes.

Chemical engineering	1. Thermodynamics	2. Chemical synthesis
	3. Oxidations	4. Reactive distillation
	5. Reductions	6. Thermochemicals
	7. Alkylations	8. Other:
Network engineering	1. Automata theory	2. Distributed computing
	3. Computability theory	4. Parallel computing
	5. Computational complexity theory	6. Network security
	7. Compilers	8. Signal Processing
Mechanical engineering	1. Mechanics	2. Structural failure analysis
	3. Kinematics	4. Thermodynamics
	5. Drafting	6. Heat transfer
	7. Energy conversion	8. Nanotechnology
Civil engineering	1. Structural analysis	2. Forensic engineering
	3. Structural design	4. Seismic engineering
	5. Hydrologic design	6. Geodetic surveying
	7. Regression and correlation analyses	8. Other:
Electrical engineering	1. Electrical field	2. Electrical potential
	3. Electrical charge	4. Electrical current
	5. Electrical energy	6. Electrical power
	7. Electrical potential	8. Other:

Common engineering vocabulary

Find examples of sentences using these words in a dictionary, a scientific paper, or on the Internet.

beam	body	to calculate	case	center
change	chapter	component	to consider	constant



Companies in the field

Chemical engineering p. 20	Bonding
Network engineering p. 21	Peer-to-peer networking
Mechanical engineering p. 22	Mechatronics
Civil engineering p. 23	Seismic engineering
Electrical engineering p. 24	Electrostatics

Sample

Knowledge about engineering companies

1. What are some famous companies in your area of engineering?
2. Do these companies have branches overseas, too?
3. What kind of work do they do?
4. Have you ever looked at the websites of engineering companies?
5. Is it better to work for a small company or a large corporation?

Questions about the last unit's and today's readings

6. What did you learn about in the last unit of this textbook?
7. What do you know about the topic of the reading in this unit? (Choose your specialization from pages 20-24)
8. Do you think this topic is important?

Setting up a company

9. Do you know anyone who has started their own company?
10. Would you like to set up your own company?
11. If you set up a company, what would it do?