
TABLE OF CONTENTS

ABOUT THE AUTHOR

TABLE OF CONTENTS

CHAPTER 1 ETHICS

1.1	Comments on the Official Ethics Document	10-1
1.2	NCEES Model Rules of Professional Conduct	10-3
1.2.1	Preamble	10-3
1.2.2	Registrant's Obligation to Society	10-4
1.2.3	Registrant's Obligation to Employer and Clients	10-5
1.2.4	Registrant's Obligation to Other Registrants	10-7
1.2.5	Action Preference Is The Opposite Of The Duty Hierarchy ..	10-7
1.3	Typical Examples of P.E. Problems	10-9
1.3.1	Example Problem 1 — Duty of the Public	10-9
1.3.2	Example Problem 2 — Limit Your Practice to Your Competency Area	10-9
1.3.3	Example Problem 3 — Duty to the Public Over Duty to all Others	10-10
1.3.4	Example Problem 4 — Duty is Related to Competency not Cost	10-10
1.3.5	Example Problem 5 — Job Bidding	10-11

CHAPTER 2 ETHICS FOR ENGINEERING PROFESSIONS

2.1	Overview And Purpose and Practical Effect	10-13
2.1.1	Purpose	10-13
2.1.2	Licensed or Unlicensed in California	10-13
2.1.3	Tort	10-14

2.1.4	Overview of the California Business & Professions Code	10-14
2.1.5	Independent Contractor vs. Employee Status	10-15
2.1.6	Intellectual Property Created by a Contractor vs. Employee ..	10-15
2.2	Example of a Code Of Ethics	10-15
2.2.1	Fundamental Principles	10-15
2.2.2	Fundamental Canons	10-16
2.3	Relationship of Engineering Societies	10-20
2.3.1	Ethics and Professionalism	10-21
2.3.2	Avoiding Liability Suits	10-23

TABLE OF CONTENTS

NOTE FROM THE EDITOR

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

1.1	Computers	11-1
1.1.1	Brief history of Computers Prior to PC's	11-1
1.2	NCEES FE Exam Scope	11-3

CHAPTER 2 NUMBER SYSTEMS

2.1	Number Systems	11-5
2.1.1	Decimal System	11-6
2.1.2	Binary System	11-6
2.1.3	Octal system	11-7
2.1.4	Hexadecimal or Hex system	11-7

CHAPTER 3 DATA STORAGE AND TRANSMISSION

3.1	Data Storage	11-9
3.1.1	BITS	11-9
3.1.2	Byte	11-9
3.1.3	Word	11-9
3.2	Memory	11-10
3.2.1	CPU	11-10
3.2.2	GUI	11-10
3.2.3	Operating System (OS)	11-10

3.2.4	RAM (Random Access Memory)	11-10
3.2.5	ROM (Read Only Memory)	11-10
3.2.6	PROM (Programmable Read Only Memory)	11-11
3.2.7	Cache	11-11
3.2.8	Virtual Memory	11-11
3.3	Magnetic Media	11-11
3.3.1	Floppy Disks	11-11
3.3.2	Magnetic Media Disk Drives	11-12
3.3.3	Hard Drives	11-12
3.3.4	Removable Hard Disk Cartridges	11-12
3.3.5	Tape Drives	11-12
3.3.6	CD Roms	11-13
3.3.7	Optical Hard Drives	11-13
3.3.8	DVD TechnolOgy	11-13
3.4	Data Transmission	11-13
3.5	Modems	11-14
3.5.1	Transmission	11-14
3.5.2	Transmission Protocols	11-14
3.6	Example Problems	11-15
3.6.1	Example Problem 1 – Processing Speed	11-15
3.6.2	Example Problem 2 – Intense computations	11-15
3.6.3	Example Problem 3 – Transmission Time	11-16
3.6.4	Example Problem 4 – Transmission Time	11-16

CHAPTER 4

PSEUDO-CODE AND FLOWCHARTS

4.1	Introduction to Programming	11-17
4.2	Pseudo-Code	11-18
4.2.1	Example Problem 1 – Pseudo-code	11-18
4.2.2	Example Problem 2 – Pseudo-code	11-19
4.3	Flowcharts	11-20
4.4	Flowchart Symbols	11-20
4.5	Example Problems	11-21
4.5.1	Example Problem 1 – Flowchart	11-21
4.5.2	Example Problem 2 – Flowchart	11-21

4.5.3	Example Problem 3 — Flow Charts/Pseudo Code	11-22
4.5.4	Example Problem 4 — Flow Charts/Pseudo Code	11-22
CHAPTER 5		
PROGRAMMING CONCEPTS		
5.1	Major Program Components	11-23
5.1.1	Main Program	11-23
5.1.2	Subroutine definition	11-24
5.1.3	Function definition	11-24
5.2	Variable Declarations	11-25
5.2.1	Type Definitions	11-25
5.2.2	Strong Typing	11-26
5.3	Array Declaration	11-26
5.3.1	Array Declarations with Strong Typing	11-26
5.4	Data Statements (Constants Declaration)	11-27
5.5	Mathematical Statements	11-27
5.5.1	Math Symbol Hierarchy	11-27
5.5.2	Miscellaneous Math Symbols	11-28
5.6	Built-In Function Calls	11-28
5.7	Boolean Algebra	11-28
5.8	“If Then” Logic	11-29
5.8.1	if – Then Example	11-29
5.8.2	Case Statements	11-29
5.9	Goto (Old but Still Around)	11-30
5.10	Loops	11-30
5.10.1	“Do While” or “Do Until” Logic Loops	11-30
5.10.2	“For” Loops or Counter Loops	11-31
5.11	Input/Output	11-31
CHAPTER 6		
SPREADSHEET APPLICATIONS		
6.1	Spreadsheet Applications	11-33
6.2	Spreadsheet Examples	11-34
6.2.1	Example Problem 1 – Simple Spreadsheet	11-34
6.2.2	Example Problem 2 — Simple Spreadsheet	11-35

6.2.3	Example Problem 3 — Simple Spreadsheet	11-36
6.3	Multiple Choice Problems	11-37
6.3.1	Example Problem 1 — Spreadsheets	11-37
6.3.2	Example Problem 2 — Spreadsheets	11-37
6.3.3	Example Problem 3 — Spreadsheets	11-37

CHAPTER 7

NCEES REFERENCE FOR COMPUTER KNOWLEDGE

TABLE OF CONTENTS

ABOUT THE AUTHOR

REFERENCES

CHAPTER 1

INTRODUCTION

1.1	EIT Circuit Questions	12-1
1.2	DC Circuits	4-1
1.3	AC Circuits	12-2
1.4	Operational Amplifiers and Diodes	12-2

CHAPTER 2

DC NETWORKS

2.1	Charge (q)	12-3
2.2	Electric Field (e)	12-3
2.3	Voltage (v)	12-5
2.4	Current (i)	12-6
2.5	Magnetic Field	12-6
2.6	Circuit Symbols	12-9
2.7	Nodes and Loops	12-9
2.8	Kirchoff's Current law	12-10
2.9	Kirchoff's Voltage Law	12-10
2.10	Power: Passive Convention	12-11
2.11	Resistor and Resistivity	12-12
2.12	Series and Parallel Equivalent Resistance	12-12
2.13	Current Divider	12-14
2.14	Voltage Divider	12-14
2.15	Simple Circuit Examples	12-15
2.15.1	Example 1	12-15
2.15.2	Example 2	12-15

2.16	Circuit Equations	12-16
2.17	Node Equations	12-16
2.18	Mesh Equations	12-17
2.19	Thevenin Equivalent	12-18
2.20	Norton Equivalent	12-19
2.21	Maximum Power Transfer Theorem	12-20
2.22	Delta-Wye and Wye-Delta Transformations	12-21
2.23	Superposition	12-22

CHAPTER 3

AC NETWORKS

3.1	Introduction	12-23
3.2	Capacitors and Inductors	12-23
3.3	Capacitors	12-24
3.4	Inductors	12-25
3.5	Inductive Coupling	12-27
3.6	Mesh Equations for RLC Network	12-28
3.7	First Order Differential Equations	12-29
3.8	Switched RL or RC Circuits	12-29
3.9	RL Circuit Example	12-31
3.10	RC Circuit Example	12-33
3.11	Impedance	12-34
3.12	Forced Response Using Phasors	12-35
3.13	Phasors	12-36
3.14	Leading and Lagging	12-38
3.15	Time and Phasor Relationships	12-39
3.16	Phasor Example	12-40
3.17	Resonance	12-40
3.18	Bandwidth	12-42
3.19	Quality Factor	12-42
3.20	Average Power	12-43
3.21	Maximum Power	12-44
3.22	Complex Power	12-44
3.23	Power Factor Effect on Delivered Current	12-44
3.24	Ideal Transformers	12-45
3.25	Three-Phase Power	12-46

CHAPTER 4
OPERATIONAL AMPLIFIERS AND DIODES

4.1	Operational Amplifiers	12-51
4.2	Diodes	12-55

CHAPTER 5
EXAMPLE PROBLEMS FOR ELECTRICAL CIRCUITS

CHAPTER 6
SOLUTIONS TO EXAMPLE PROBLEMS

CHAPTER 7
NCEES FORMULAS FOR ELECTRICAL CIRCUITS

INDEX

TABLE OF CONTENTS

CHAPTER 1 FUNDAMENTAL CONCEPTS

1.1	Scope of Thermodynamics	9-1
1.2	Thermodynamic Systems	9-1
1.3	Properties of a System	9-2
1.4	Thermodynamic Processes	9-2
1.5	Thermodynamic Equilibrium	9-3
1.6	Thermodynamic Properties of a Substance	9-3
1.6.1	Intensive Properties	9-3
1.6.2	Extensive Properties	9-5
1.7	Example Problems	9-9
1.7.1	Example Problem 1	9-9
1.7.2	Example Problem 2	9-9
1.7.3	Example Problem 3	9-10
1.7.4	Example Problem 4	9-10
1.7.5	Example Problem 5	9-10
1.7.6	Example Problem 6	9-11
1.7.7	Example Problem 7	9-12
1.7.8	Example Problem 8	9-13

CHAPTER 2 CHANGE OF PHASE

2.1	Phases of a Pure Substances	9-15
2.2	Steam Tables	9-18
2.3	Mollier Diagram	9-19
2.4	Superheat Tables	9-20

2.5	Gibbs Phase Rule	9-20
2.6	Example problems	9-20
2.6.1	Example problem 1	9-20
2.6.2	Example problem 2	9-21
2.6.3	Example problem 3	9-21

**CHAPTER 3
BASIC EQUATIONS**

3.1	General Energy Equation	9-23
3.2	Steady Flow Systems	9-24
3.2.1	Compressors, Turbines	9-24
3.2.2	Pumps or Hydroturbines	9-25
3.2.3	Nozzles, Diffusers	9-25
3.2.4	Throttling Valves	9-25
3.2.5	Heat Exchangers	9-25
3.2.6	Boilers, Condensers, Evaporators	9-26
3.3	Equation of State	9-26
3.4	Atmospheric Air — Psychrometrics	9-31
3.5	Example Problems	9-33
3.5.1	Problem 1	9-33
3.5.2	Problem 2	9-33
3.5.3	Problem 3: Psychrometrics	9-33

**CHAPTER 4
WORK, HEAT, THERMODYNAMIC LAWS, AND
THERMODYNAMIC PROCESSES**

4.1	Work	9-35
4.2	Heat	9-36
4.3	Indicator Diagrams	9-36
4.4	Laws of Thermodynamics	9-37
4.5	Availability	9-39
4.6	Thermodynamic Processes Evaluation	9-39
4.7	Carnot Cycle	9-40
4.8	Example Problem	9-43
4.8.1	Problem No. 1	9-43
4.8.2	Problem No. 2	9-43
4.8.3	Problem No. 3	9-44

CHAPTER 5
HEAT TRANSFER

5.1	Heat Conduction	9-45
5.2	Convection Heat Transfer	9-49
5.3	Thermal Radiation	9-52
5.4	Heat Exchangers	9-54
5.5	Example problem	9-55
5.5.1	Example problem 1	9-55

CHAPTER 6
VAPOR POWER CYCLES

6.1	Vapor Heat Engine/General Vapor Power Cycle	9-57
6.2	Carnot Steam Cycle	9-60
6.3	Rankine Cycle	9-61
6.4	Rankine Cycle with Superheat	9-62
6.5	Rankine Cycle with Reheat	9-63
6.6	Example Problems	9-64
6.6.1	Example problem 1	9-64
6.6.2	Rankine cycle with superheat	9-65
6.6.3	Example problem 2	9-67

CHAPTER 7
INTERNAL COMBUSTION ENGINE CYCLES

7.1	Internal Combustion Engine	9-69
7.2	Air-Standard Carnot Cycle	9-69
7.3	Air-Standard Otto Cycle	9-71
7.4	Air-Standard Diesel Cycle	9-72
7.5	Air-Standard Dual Cycle	9-73
7.6	Brayton or Air-Standard Joule Cycle (for gas turbines)	9-74
7.7	Brayton Cycle with Regeneration	9-76
7.8	Stirling Cycle	9-77
7.9	Example Problems	9-78
7.9.1	Example Problem 1 – Otto Cycle	9-78

CHAPTER 8
REFRIGERATION AND AIR CONDITIONING PROCESSES

8.1	Reversed Carnot Refrigeration Cycle (Reversed Power Cycle)	9-81
-----	--	------

8.2	Vapor Compression Cycle	9-82
8.3	Air Refrigerator Cycle (Reversed Brayton Cycle)	9-83
8.4	Heat Pumps	9-84
8.5	Air Conditioning Processes	9-84

**CHAPTER 9
COMBUSTION**

9.1	Combustion Processes	9-87
9.2	Example Problems	9-88
9.2.1	Problem No. 1	9-88
9.2.2	Problem No. 2	9-88
9.2.3	Problem No. 3	9-89

**CHAPTER 10
NCEES FORMULAS THERMODYNAMICS**

10.1	Properties of Single Component Systems	9-91
10.1.1	Nomenclature	9-91
10.1.2	State Functions (Properties)	9-91
10.2	Mach Number	9-93
10.3	First Law of Thermodynamics	9-93
10.3.1	Closed Thermodynamic System (No Mass Crosses Boundary)	9-94
10.3.2	Special Cases of Closed Systems	9-94
10.3.3	Open Thermodynamic System (Allowing Mass to Cross the Boundary)	9-94
10.4	First Law (Energy Balances)	9-95
10.4.1	Special Cases of Open Systems	9-95
10.4.2	Steady State Systems	9-95
10.4.3	Special Cases of Steady Flow Energy Equation	9-96
10.5	Basic Cycles	9-97
10.6	Ideal Gas Mixtures	9-97
10.6.1	Partial Pressures	9-98
10.6.2	Partial Volumes	9-98
10.6.3	Dalton's Law	9-98
10.6.4	Other Properties	9-98
10.7	Psychrometrics	9-99
10.7.1	Psychrometric Chart	9-99

10.8	Phase Relations	9-99
10.8.1	Gibbs Phase Rule	9-100
10.8.2	Gibbs Free Energy	9-100
10.8.3	Helmholtz Free Energy	9-100
10.9	Combustion Processes	9-100
10.9.1	Combustion in Air	9-100
10.9.2	Combustion in Excess Air	9-100
10.9.3	Incomplete Combustion	9-100
10.10	Second Law of Thermodynamics	9-101
10.10.1	Thermal Energy Reservoirs	9-101
10.10.2	Kelvin-Planck Statement of Second Law	9-101
10.10.3	Clausius Statement of Second Law	9-101
10.11	Vapor-Liquid Mixtures	9-101
10.11.1	Henry's Law at Constant Temperature	9-101
10.11.2	Raoult's Law for Vapor-Liquid Equilibrium	9-102
10.12	Entropy	9-102
10.12.1	Inequality of Clausius	9-102
10.12.2	Isothermal, Reversible Process	9-102
10.12.3	Isentropic Process	9-102
10.12.4	Adiabatic Process	9-103
10.12.5	Increase of Entropy Principle	9-103
10.12.6	Temperature-Entropy (T-s) Diagram	9-103
10.12.7	Entropy Change for Solids and Liquids	9-103
10.12.8	Irreversibility	9-103
10.12.9	Closed-System Availability	9-103
10.12.10	Open-System Availability	9-103
10.13	Heat Transfer	9-109
10.13.1	Conduction	9-109
10.13.2	Convection	9-110
10.13.3	Radiation	9-111