SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Electrical Machine-I **Course Code: 17YEE401**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	2	4	10	20	10	10	25	50	25	150
Max. Time, End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – 2Hrs.**		

Objectives	
1	To understand construction, working principle, regulation & efficiency of Transformer.
2	To understand Load Sharing and parallel operation of Transformer.
3	To learn characteristics of single-phase induction motor.
4	To Understand the Construction and working of 3 Ph Induction Motor
5	To understand construction & working principle of DC machines
6	To study different starters and speed control of DC machines.

Unit Number	Details	Hours
I	**Basic Electromagnetic Field Theory**: Field theory principle for operation of single phase and three phase AC& DC machines. (principle of conduction, induction-self/mutual, RMF, cross field theory/Double field theory) **Single phase Transformer**: Definition, Ideal transformer, Transformation ratios, classification, No-load & On-Load performance, Phasor diagram, Equivalent circuit, losses, efficiency, Condition for maximum efficiency.	9
II	**Testing of Single phase Transformer**: Polarity test, Parallel operation of single phase transformers, load test, Autotransformer: - construction, working, application, Testing of transformer as per Indian standard. Open circuit and short circuit tests, Determination of equivalent circuit parameters and voltage regulation	8
III	**Three phase Transformer**: Construction, Classification, Standard connections along with voltage phasor diagrams and vector groups, applications, testing,; Power transformer, and distribution transformer. Three phase to single phase, two phase, six phase, and twelve phase conversion. Three-winding transformer and tap changing transformer, Concept of no-load current and inrush current phenomenon, Descriptive treatment of Parallel operation of three phase transformers, Scott connection and V connections. Three winding (tertiary windings) transformers	10
IV	**D.C. Machines**:- Construction, principle of operation, Emf equation, Armature winding – Lap, wave, single layer, double layer, Armature reaction and commutation, method of improving commutation. D.C. Generator, Types, characteristics d.c. shunt, series and compound generators, significance of Back EMF, Voltage Equation of Motor, Torque equation of motor, Characteristics and applications of D.C. Shunt, Series and compound Motors, Starting of DC motors, starters, solid state starters, speed control of DC motors (Armature & Flux control)	9

V	**Induction Motor :-** **Three phase induction motor:-**Construction, working Principal, classification, Torque Equation, condition for max torque, Torque slip characteristics. application. **Single phase induction motor**: Introduction, Construction, working, methods of self-starting, Classication, Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run motor and permanent capacitor motor). Shaded pole induction motor, Repulsion types motors.	9
	Total	**45**

Course Outcome	
Students should able to	
CO1	Apply Basic field theory to Learn Electrical Machines.
CO2	Test the Transformer for Direct and Indirect Tests for Analysis.
CO3	Select transformer according to the requirement of delta or star application
CO4	Control the speed of DC Motors using armature voltage control and Flux control for specific Drive Operation.
CO5	Effectively Characterize and select Induction motor Specifications based on the Application.

Practical Objective	
1	To provide knowledge about testing of electrical machines
2	To provide knowledge about speed control of electrical motors

Sr. No.	**Description**
1	O.C. and S.C. test on single phase Transformer.
2	Polarity test on single phase and three phase transformer
3	Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedances.
4	To study the Scott connection of transformer and verify different types of connection of three phase transformer
5	Determination of regulation and efficiency by direct load test on transformer
6	Speed control of D.C. Shunt motor and study of starters
7	Brake test on D.C. Shunt motor
8	Load characteristics of D.C. series motor
9	Hopkinson's test on D.C. shunts machines.
10	Load test on 1-phase CSCR induction motor.
11	Load test on 1-phase A.C. Series motor
12	Introduction to Open source software for electrical machines

Resources	
Recommended Books	1. Electrical Machine 2nd Edition by S. K. Bhattacharya, Tata Mc Graw Hill publishing Co. Ltd. 2. Electrical Machines by Ashfaq Husain, Dhanpat Rai & Sons 3. Electrical Machines by Nagrath& Kothari, Tata Mc Graw Hill.
Reference Books	1. Performance and Design of Direct Current Machines Third Edition by A.E. Clayton and N.N. Hancock, CBS Publishers. 2. Electrical Machines Fifth Edition by A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans Tata Mc Graw Hill Publication Ltd. 3. Theory and performance of DC machines by A.S. Langsdorf, Tata Mc Graw Hill. **4.** Electrical Machines Theory, Application, & Control, Second Edition by Charles I Hubert, Pearson Education, New Delhi.
E-Resources	http://nptel.ac.in/

SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Microcontroller and Applications **Course Code: 17YEE402**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Theory**	**Lab**	
3	-	2	4	10	20	10	10	25	50	25	150
Max. Time, End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) - 2Hrs.**		

Prerequisite Basic binomial, hexadecimal algebra, Basics of programming

Course Objectives	
1	To introduce the architecture and operation of typical Microprocessors and Microcontrollers.
2	To introduce detailed internal structure of microcontrollers
3	To provide solid foundation on interfacing the external devices to the µC according to the user requirements to create novel products and solutions for the real time problems
4	To develop assembly level programming and providing the basics
5	To provide strong foundation for designing real world applications Using microcontrollers

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Introduction:** Difference between Microprocessor & Microcontroller, bits and bytes logic, Memory types and memory organization, Input / output devices, generalized Architecture diagram.	5
	II	**Introduction to 8051:** Architecture, functional block diagram, Pin diagram, stack operation, internal memory organization, special function register, Ports	4
2	I	**Instructions & programming for 8051:** Instructional word types, Addressing modes, 8-bit operational programming, 16-bit operational programming.	5
	II	**Timers and Counters**: Basics of Timers, Programming for timers and counters	3
3	I	**Interrupt and programming:** Basics of interrupts, Polling vs	5

		interrupts, Programming for interrupts,	
	II	**ADC and DAC Programming:** ADC and DAC interface, basic operations, programming for ADC and DAC interface with 8051	5
4	I	**Arduino Microcontroller and its interfacing:** Types of Arduino boards, Specifications, Arduino IDE, Programming for Arduino	5
	II	**Arduino Microcontroller and its Programming:** Basic Arduino applications, LED interfacing, Serial Communication Protocols USART, SPI, I2C and their application	4
5	I	**Introduction to PIC microcontroller:** Basics of PIC microcontrollers, Applications using PIC µC, Example and case studies.	5
	II	**Microcontroller applications:** Various sensors and their interfacing Applications such as temperature measurement, Pressure measurement, DC motor interfacing.	4
		Total No. of Hrs	45

Beyond the Syllabus
Programming for PIC microcontrollers, IOT

Course Outcome	
Students should able to	
CO1	Explain the microprocessor's and Microcontroller's internal architecture and its operation within the area of manufacturing and performance.
CO2	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microcontroller
CO3	Analyse assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.
CO4	Understand key concepts of embedded systems like I/O, timers, interrupts, interaction with peripheral devices
CO5	Evaluate assembly language programs and download the machine code that will provide solutions to real world control problems.

List of Experiments	
Sr.No.	**Description**
1	**Module 1** a. Introduction to 8051 board b. Assembly Programming for basic operations using 8051
2	**Module 2** a. Introduction to Arduino UNO board b. Basic programming using Arduino IDE c. Conditions, loops, important library functions d. Modular programming using functions
3	**Module 3** a. LED interface and traffic signal application b. Traffic signal application without delay () function
4	**Module 4** a. IR sensor integration and Serial communication b. LCD interface c. Bluetooth interface

Recommended Resources	
Text Books	1. M.A. Mazidi, R.D. McKinlay, J.G. Mazidi, "The 8051 Microcontroller: A Systems Approach", Pearson, 2013 2. Massimo Banzi, "Make - Getting Started with Arduino" Shroff Publishers, 2014 3. M.Bates, "PIC Microcontrollers", Newnes, 2011
Reference Books	1. "The 8051 Microcontroller and Embedded Systems: Using Assembly and C" by Muhammad Ali Mazidi 2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman, CRC Press
E-Resources	https://tech-iitb.org/erc/tutorials/arduino http://www.me.umn.edu/courses/me2011/arduino/ https://www.arduino.cc/

SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Power System-I **Course Code: 17YEE403**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	-	2	4	10	20	10	10	25	50	25	150
Max. Time, End Semester Exam (Theory) -3Hrs.									End Semester Exam (Lab) - 2Hrs.		

Objectives	
1	To understand structure of electrical power system with the help of single line diagram and tariff setting principles.
2	To understand various major equipment with functions used in power station and construction of cables with methods of cable fault detections.
3	To understand various factors to be considered while mechanical design of overhead line for specific electrical and environmental conditions.
4	To evaluate the resistance and inductance of transmission line.
5	To calculate capacitance of transmission line with and without effect of earth surface on electric field.
6	To understand the component of distribution system

Course Outcome	
Later effective conclusion of course, a student should be able to	
CO1	Identify different shapes of load curvature, estimate dissimilar features linked with it, demand supply equilibrium and tariff structure for L.T. and H.T. clients.
CO2	Analyze several features, ratings, application of different electrical equipment's in power station and be aware of choice of cable, building, organization, dielectric stress in underground cables.
CO3	Be aware of selection of overhead line insulators and analyze a transmission line considering mechanical aspects.
CO4	Compute and investigate, resistance and inductance of overhead transmission line for unlike configurations.
CO5	Calculate and analyze capacitance of overhead transmission line for different configurations, with and without effect of earth.

Module Number	Details	Hours
I	**Structure of Electrical Power Systems:** **Structure of Electrical Power Systems:** An overview of Electrical Energy Generation General background, structure and components of electrical power system. **Major Electrical Equipment's in Power Stations:** Function and special features of all major equipment's in substation and generating station such as, alternators, exciters, transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays, current transformers, Potential transformers, Lightning arresters, Earthing's switches, isolators.	9
II	**Power Plant Economics -** Load curves, base load, peak load, methods of meeting the load demand, maximum demand, demand factor, average load, load factor, diversity factor, plant capacity factor, reserve capacity, plant use factor. **Tariff:** Introduction of tariff, types of tariff desirable characteristics of tariff, Time of the day tariff (TOD).	9
III	**Underground Cable:** Classification, Construction of cable, XLPE cables, insulation resistance, dielectric stress in single core cable, capacitance of single core and three core cables. D.C cable, grading of cables, inter sheath grading, capacitance grading. **Overhead Line Insulators:** Types of insulators & their applications such as pin type, suspension type, strain type, Shackle insulators, Silicon Rubber insulators/ composite insulators, post insulators, stray insulators, glass insulators. Insulator failure, voltage distribution along string of suspension insulators, string efficiency, equalization of potential across each unit, methods of improving string efficiency.	9
IV	**Mechanical Design of Overhead Lines:** Main components of overhead lines, Line supports, conductor spacing, length of span, calculation of sag for equal and unequal supports and effect of ice and wind loadings, some mechanical principles related to safety.	9
V	**Resistance, Inductance and Capacitance of Transmission Line:** Constants of transmission lines, resistance of transmission line, skin effect and its effects, proximity effect, flux linkages, internal & external flux linkages of single conductor, inductance of single phase two wire line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of G.M.R. and G.M.D. Electric potential at single charged conductor, potential at conductor in a group of charged conductors, capacitance of single phase line, Capacitance of single phase line, effect of earth's surface on electric field, Concept of G.M.R. and G.M.D for capacitance calculations, capacitance of three phase line with symmetrical and unsymmetrical spacing.	9
	Total	**45**

List of Experiments	
Sr.No.	**Description**
1	To Study the Supply from generating station to areas in need.
2	Study of component of Substation.
3	To study & draw the different types of insulator.
4	Study of various type's of conductor.
5	Determination of Transmission Parameters of a transmission line.
6	To study & draw Towers used in Transmission lines.
7	To study & design Electrical Power Transmission line

Resources	
Recommended Books	1. C. L. Wadhwa, "Electrical Power Systems", New Age 2. I.J. Nagarath and D. P. Kothari , "Modern Power System Analysis", Tata McGraw Hill 3. D.P. Kothari, I.J. Nagrath, Power System Engineering Tata McGraw Hill
Reference Books	1. M. V. Despande, "Electrical Power Systems Design", Tata McGraw Hill 2. J. J. Grainger and W.D. Stevenson, "Power System Analysis", McGraw Hill 3. Edwin, I. Harder "Fundamentals of Energy Production", John Wiley and Sons, 1982. 4. Burke James, J., "Power Distribution Engineering; Fundamentals and Applications" Marcel Dekker, 1996.
E-Resources	1. http://nptel.ac.in/courses/108102047/23

SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Numerical Methods **Course Code: 17YEE404**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	0	3	10	20	10	10	-	50	-	100
Max. Time, End Semester Exam (Theory) -3Hrs.									End Semester Exam (Lab) - NA		

Prerequisite **1.** Basic knowledge of Numerical Methods & understand simple programming methods

Objectives	
1	Provide sound knowledge of various numerical methods.
2	Impart skills to develop programs using C language.
3	Analyzing skill of student for solving complex numerical problems.
4	Evaluation using various computational technique.
5	Motivate student for global problem solving and analyzing of complex engineering problems.

Unit Number	Details	Hours
I	**Solution of Transcendental and Polynomial Equation**: Concept of roots of an equation. Descartes' rule of signs, Intermediate value theorem, Synthetic division, Roots of Polynomial Equations using Bisection method, Secant method, Regula - Falsi method and Newton - Raphson method. Newton - Raphson method for two variables.	10
II	**Solution of Equations by Iteration:** Solution of equation by fixed point iteration method, Solution of linear system by Gaussian elimination and Gauss-Jordon method. Gauss-Seidel method, Inverse of a matrix by Gauss Jordon method. Curve Fitting using least square approximation–First and second order.	10
III	**Eigen value Problems, Interpolation and Approximation:** Eigen value of a matrix by power method and by Jacobi method for symmetric matrix. Lagrangian polynomials and interpolation, Newton's forward and backward difference.	9
IV	**Numerical Differentiation And Integration:** Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules.	9
V	**Initial Value Problems for Ordinary Differential Equations**: Single step methods: Taylor series method – Euler method for first order equation –Fourth order Runge – Kutta method for solving first and second order equations, Finite difference solution of 2^{nd} order ordinary differential equation.	8
	Total	**46**

Course Outcome	
Students should able to	
CO1	Simulates an algebraic and transcendental equation using appropriate numerical method.
CO2	Aware about the numerical solutions techniques of linear and non-linear system of equations.
CO3	Find approximate curve fitting using interpolating techniques.
CO4	Recognize the numerical integration and differentiation techniques.
CO5	Identify and interpret of errors in numerical methods.

Resources	
Recommended Books	1. Numerical Methods, second edition, by S. Arumugan, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications (India) Pvt. Ltd 2. Sankara Rao K, 'Numerical Methods for Scientisits and Engineers' – 3rd editiionPrintice Hall of India Private Ltd, New Delhi, (2007). 3. Numerical Methods with Programs in C and C++ by T. Veerarajan and T. Ramchandran, Tata McGraw Hill Publication
Reference Books	1 Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007. 2 Numerical Methods by E. Balgurusamy, Tata McGraw Hill Publication.
E-Resources	http://nptel.ac.in/

SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Analog and Digital Electronics **Course Code: 17YEE405**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
3	0	2	4	10	20	10	10	25	50	25	150
Max. Time, End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – NA**		

Prerequisite

1. Basic knowledge of Semiconductor theory.
2. Concept of different amplifiers circuits
3. Fundamental concept of digital circuits with their applications.

Objectives	
1	To provide the concept of various components & basic knowledge of designing Analog and digital circuits.
2	Understand and apply IGBT to control system and observe its performance parameter
3	Demonstrate and Analyze Operational Amplifier circuits and their applications
4	Familiarize with gate circuits their applications
5	To demonstrate various counters, flip flops and shift register.

Unit Number	Details	Hours
I	**Introduction:** BJT, DIAC, TRIAC, Diode, FET, MOSFET Transistor – Symbol, Construction, Equivalent Circuit, Operation, Characteristics & Parameters, Applications.	9
II	**IGBT–** Basic Structure and Operation, Static Characteristics, Dynamic Switching Characteristics, Input and Output Characteristics, IGBT Performance Parameters, Gate Drive, Protection, Applications.	7
III	**Operational Amplifiers:** Operational Amplifiers and linear applications: Block diagram, Ideal Op-amp, Equivalent circuit,Transfer characteristics. Op-amp with negative feedback, Frequency response, Op-amp IC 741 specifications, Basic op-amp applications: Adder, Scalar, Subtractor, Difference amplifier,	8
IV	**Applications of op-amp:** Op-amp as Sine wave, Triangular wave, Square wave generator. Op-amp as a Schmitt trigger, ZCD, Comparator, Instrumentation Amplifier, Voltage Regulator and components: Series and Shunt Regulator. Regulator ICs 78XX, IC 79XX.	8

V	**Numbering System & Codes:** Binary, Octal, Decimal and Hexadecimal number Systems and their conversion, Binary Addition and Subtraction, Boolean Algebra and Logic Gates: Standard SOP and POS form, Reduction of Boolean functions using Algebraic method, K -map method (2,3,4 Variable). **Basic Digital Circuits:** Gates, Flip Flops, Counters, Design of Counters, IC 74193 Shift Registers: Shift Register IC 7496, SISO, SIPO, PIPO, PISO, Bidirectional Shift Register, Universal Shift Register.	11
	Total	**45**

Course Outcome	
Students should able to	
CO1	Describe and analyze basic need of digital electronic devices such as BJT, TRIAC, FET, Diode and their applications in control system.
CO2	Apply IGBT in controlling electrical parameter and also capable to describe it's characteristics.
CO3	Understand operational amplifier in detail and its application in electrical engineering
CO4	Design and implementation of voltage regulator circuit use of ZCD
CO5	Solve problems related to number systems and Boolean algebra.

Sr.	**Practical Description**
1	Study of IC78XX & 79XX.
2	Study of up -down counters (IC 74192/74193) and N - modulo counter. (IC 7490/7493)
3	Study of Op-amp as Schmitt trigger
4	Study of Instrumentation amplifier using three Op-amp, CMR measurement
5	Study of Op-amp as sine, and triangular wave generator
6	Study of IC-555 applications-astable, monostable multivibrator.
7	Study of Single Phase Full-wave bridge rectifier with RL load.
8	Study of Transistor amplifiers: frequency response of BJT, multistage BJT amplifier
9	Study of Single Phase Half-Wave Rectifier.
10	Study of op-amp as a ZCD & Comparator
11	Study of various flip-flops and verification of truth table.
12	Study and verify shift register operation (IC 7495).

RecommendedResources	
Text Books	1. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000. 2. Basic Electronics, A text- Lab Manual, 7th Edition. Mc- Graw- Hill Higher Education 2001 3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
Reference Books	1. David Bell A., Operational Amplifiers and Linear ICS, Prentice Hall of India, 2. David Bell A., Laboratory for Electronic Devices and Circuits, Prentice Hall of India, 2007. 3. Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
E-Resources	http://nptel.ac.in/courses/

SANDIP UNIVERSITY

School of Engineering and Technology

Electrical & Electronics Engineering Department

B.Tech. Electrical Engineering

Year: Second Year **Semester: IV**

Course: Artificial Intelligence and Machine Learning **Course Code: 17YEE406**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Theory	Lab	
2	0	0	2	10	20	10	10		50		100
Max. Time, End Semester Exam (Theory) -3Hrs.									End Semester Exam (Lab) – 2Hrs.		

Objectives	
1	To understand the intelligent system and its types
2	To understand the learning and traning process
3	To understand the simple neural network
4	To understand the basics of fuzzy logic
5	To understand the basics of Genetic algorithms

Unit Number	Details	Hours
I	This is an introductory intelligent systems/artificial intelligence course that will cover theoretical issues, applications and implementation techniques. To familiarize with the basic techniques of artificial intelligence/intelligent systems and it's types.	5
II	Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.	7
III	Biological foundations to intelligent systems II: Fuzzy logic, knowledge representation and inference mechanism, genetic algorithm, and fuzzy neural networks.	5
IV	Evolutionary Computation for intelligence system	3
V	Application and case studies of artificial intelligence system.	2
	Total	**22**

Course Outcome	
Later effective conclusion of course, a student should be able to	
CO1	demonstrate good knowledge of basic theoretical foundations of Artificial neural networks
CO2	demonstrate good knowledge of basic theoretical foundations of Fuzzy inferencing
CO3	demonstrate good knowledge of basic theoretical foundations of Evolutionary computation
CO4	determine which type of intelligent system methodology would be suitable for a given type of application problem
CO5	demonstrate, in the form of a major project work, the ability to design and develop an intelligent system for a selected application.

Resources	
Recommended Books	1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition
Reference Books	1. Stephen Marsland, Machine Learning: An Algorithmic Perspective 2. Christopher M. Bishop, Pattern Recognition and Machine Learning
E-Resources	http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012. http://www.cs.cmu.edu/~tom/mlbook.html.